

\$3⁶⁰

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SMART SECURITY DEVICES

BOOK 1

by

Colin Mitchell

How to build a modular alarm system

Update on Voyager FM transmitter
and
VOX MkV FM transmitter

A TALKING ELECTRONICS PTY LTD
PUBLICATION

BUILD YOUR OWN ALARM

This is our first book on alarm devices. Each project has been presented as a module to make construction and diagnosis simple. The idea is to combine them to form a fully-fledged system.

Now is the time to protect your home, office or business with our smart devices. Once you get your system up and running you can help you friends and relatives improve their security too. This book is only the start. There will be more add-on modules in future releases, so start with a minimal system now and add to it later.

3-INPUT ALARM MODULE

(see P 6) *The heart of our alarm system*
Parts & PC: \$45.00
or PC board only: \$6.70

4-SECTOR INPUT MODULE

(see P 47) *Protects the wiring to the sensors*
Parts & PC: \$28.20
or PC board only: \$5.30

BATTERY BACKED POWER SUPPLY MODULE

(see P 43) *A 700mA power supply with battery back-up*
Parts & PC: \$16.20
or PC board only: \$3.00

BATTERY BACKED SIREN MODULE

(see P 31) *Drives horn or piezo with battery back-up feature*
Parts & PC: \$11.70 - spkr version
Parts & PC \$13.20 - 1 piezo version
Parts & PC \$25.60 - 4 piezo version

CURRENT SENSOR MODULE

(see P 27) *Connects smoke detectors to any alarm*
Parts & PC: \$11.60
or PC board only: \$3.00

See Current Latch on P30 to test faulty sensors

REMOTE KEYPAD MODULE

(see P 20) *Connects a keypad to your alarm*
Parts & PC: \$29.85
or PC board only: \$4.50

VOYAGER MkII

(see P 53) *The latest update on our 800m FM bug*
Parts & PC: \$10.50
or PC board only: \$2.50

VOX MkV

(see P 58) *Our Surface-Mount voice-operated bug*
Parts & PC: \$32.50
or the 2 PC's only: \$3.60

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Smart Security Devices - book 2	\$3.60
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Learning Electronics book 2	\$3.60
Next 6 publications from TE incl post	\$18.00

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5m of fine solder \$1.00

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INTRODUCTION

In this book we have presented a range of SMART DEVICES for security and surveillance - products you wish had been invented a long time ago and made available to the home constructor.

All the projects are designed around a modular system, in which they fit together to create alarms of any size and cost, depending on your requirements.

Not only can you build large or small systems from this book but you can add to your present system to improve its performance.

Many existing alarms have short-comings. They don't perform exactly as you want.

We are aware of this and that's why we have presented a number of projects that can be added to your present system.

Improvements like soft-start siren, smoke detector with loud siren, smart extension bell, phone ring reminder, extension keypad, to mention a few. Some are in this issue, others have had to be left over for the next book.

Many of the modules are available in built-up form for those who prefer to buy things ready-made and for those in the installation business. The prices for both the kits and ready-made units are given at the beginning of each article and on the 2-page spread overleaf as well as on page 42 and the inside front cover. With these, you can design your own system by selecting the modules you need.

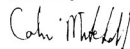
With the continuing rise in household burglaries, everyone needs additional protection. Our range meets many of these needs. The articles show how the modules go together to produce an effective alarm at very little cost.

If you have not already explored the security market as a worthwhile and interesting career, now is the time to see how new products and ideas, like the ones we are presenting, can be introduced.

In some states there are preliminary requirements like licences and qualifications before installations can be carried out on a professional basis. But this shouldn't deter you. If you are into electronics, it should be very easy to get these qualifications.

Before you do anything, build some of the modules and get an understanding of how everything goes together. Then you will be in a better position to help others.

All the best,
Don't forget the next books in this series!


Colin Mitchell

First printing 1993
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Cover price is recommended and maximum price only

CONTENTS

ALARM ORDER FORM	42
BATTERY BACKED POWER SUPPLY	43
A 700mA power supply with battery back-up.	
BATTERY BACKED SIREN	Drives 1 horn
speaker or up to 4 piezo tweeters with battery	
back-up feature	31
BUGGING HYPE	- Article
COMPLETE LIST OF TE KITS	37
CURRENT SENSOR	Connects up to 6 smoke
detectors to any alarm	27
DIGITAL ELECTRONICS	
CORRESPONDENCE SCHOOL	Learn
digital electronics at home with a 6 lesson course	52
OMNISOFTE PUBLIC DOMAIN	19
ORDER FORM	41
OVERALL VIEW OF ALARM MODULES	
2-page spread showing how to connect the	
modules together	4
REMOTE KEYPAD MODULE	Connect
this keypad module to your alarm	20
SECURITY DEVICES	- made up devices
VOYAGER MkII	An up-date article. Has air
trimmer to adjust the frequency of transmission	53
VOX MkV	Our surface-mount voice-operated bug
3-INPUT ALARM MODULE	This is the heart of
our alarm system	6
4-SECTOR INPUT MODULE	Protect the
wiring between the alarm panel and the sensors	
with this module	47

Also available from your local Dick
Smith store:

ELECTRONICS NOTEBOOK 1 - \$5.00
ELECTRONICS NOTEBOOK 2 - \$5.00
Digital Electronics REVEALED - \$5.00
14 FM BUGS TO BUILD - - - \$3.60

All the projects in this book are available in kit form from Talking Electronics. Some of the projects are also available made-up for alarm installers and those who like to buy the projects ready-made. See P 42 for details.

This publication is designed and produced by:

TALKING ELECTRONICS P/L,
35 Rosewarne Ave.,
Cheltenham, Vic 3192 ACN 006600997
Tel: (03) 584 2386
Fax: (03) 583 1854

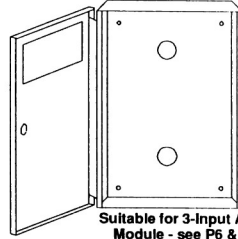
Note: Copies of this book and many of our other publications are also available from your local Dick Smith Store.

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TALKING ELECTRONICS SMART

All these modules are covered in this issue

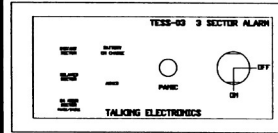
Alarm Box



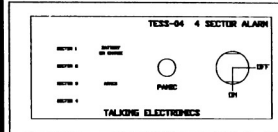
290mm x
210mm x 70mm
Metal alarm box
with cam lock
\$35.00

Suitable for 3-Input Alarm
Module - see P6 & 17.

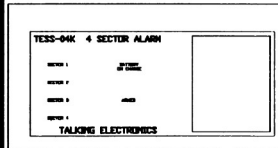
5 front panels:
see P17 for details



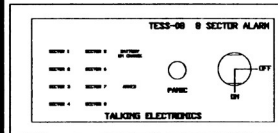
3 sector front
panel kit: **\$19.60**
incl key switch,
panic button and
wire



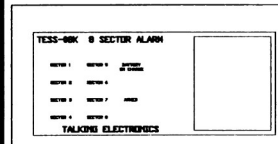
4 sector front
panel kit: **\$19.80**
incl key switch,
panic button and
wire. Use with 4-
Sector Input
Module.



4 Sector front
panel kit for
keypad: **\$9.30**
plus Keypad
Module.



8 Sector front
panel kit:
\$20.60 incl key
switch, panic
button and
wire. Use with
two 4-Sector
Input modules.

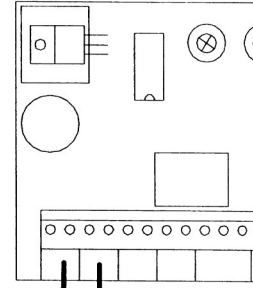


8 Sector front
panel kit for
keypad: **\$10.10**,
plus keypad
module. Use
with two 4-sec-
tor Input
Modules.

3-INPUT ALARM

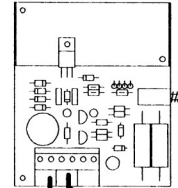


16VAC 1.5amp
plug pack **\$19.50**



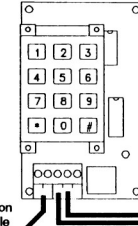
12volt 1.2amp-hr
rechargeable battery
\$28.00

Battery Backed Power
Supply Module: **\$16.20**
see P43



Key switch **\$8.50**

Remote Keypad
Module: **\$29.85**
see P 20

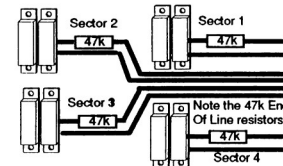


to 12v OUT on
alarm module

Strobe:
\$28.00



Panic
Button:
\$4.00



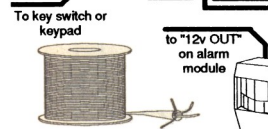
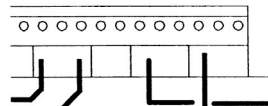
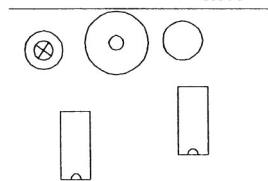
SECURITY ALARM SYSTEM - "TESS"

Diagrams by Paul

All modules are available in kit-form. Some are available ready-built for alarm installers etc. Some are designed to be added to your existing alarm system to improve its features. See the articles in this issue for further details.

MODULE: \$45.00

see P6



4-core security cable:
60¢/metre \$40/100m roll
6-core security cable:
75¢/metre \$55/100m roll

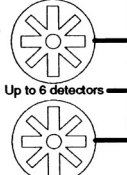
PIR: \$60.00
See P30 for low-cost PIR



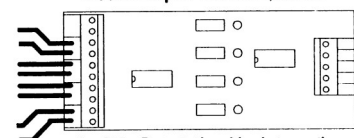
Fig 8 cable:
45¢/metre
\$30/100m roll

Smoke Detector:

\$12.00



4-Sector Input Module: \$28.20



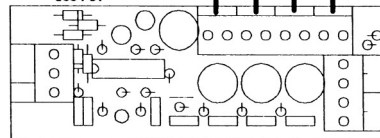
See P47. Protects the wiring between the sensors and 3-Input Alarm Module

to "12v OUT" on alarm module
12v trigger from alarm module
connect to "+12v from relay" terminal on 3-Input Alarm module

Door Strike
\$39.00
12v 300mA solenoid
see P26

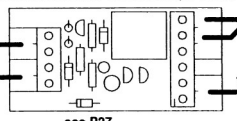


Battery Backed Siren Module:
4-Piezo Version: \$25.60
see P31

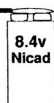


Has 5 minute "time-out"

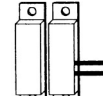
Current Sensor Module: \$11.60



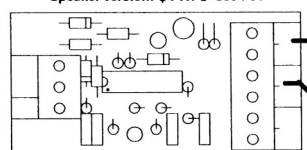
see P27



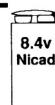
Reed switch:
\$8.00
magnet in one, reed in the other



Battery Backed Siren Module:
Speaker version: \$11.70 see P31



Has 5 minute "time-out"



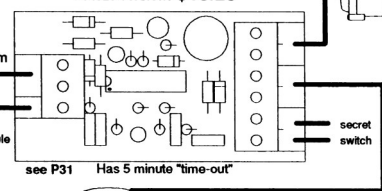
\$15.00

Horn Speaker:
\$16.00

These are called non-active piezos and Horn speakers. The circuit produces the tone.

Battery Backed Siren Module:

1-Piezo version: \$13.20

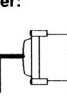


see P31

Has 5 minute "time-out"

secret switch

Piezo tweeter:
\$11.00

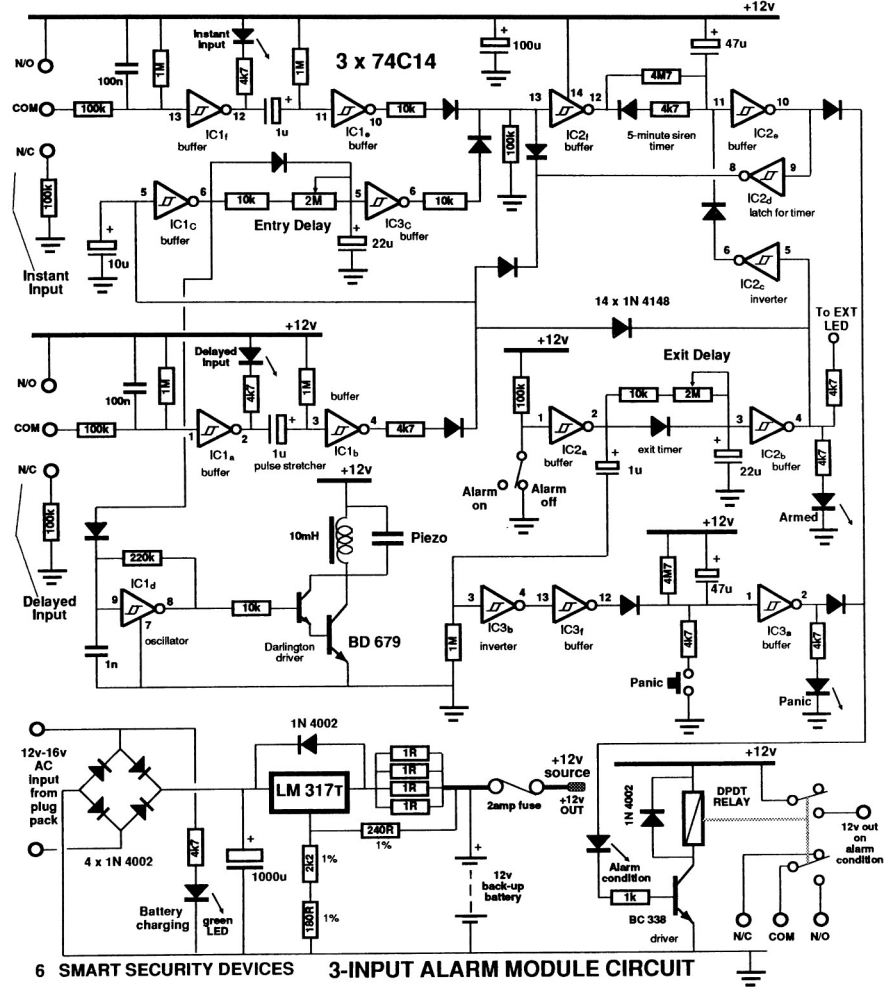


Use these diagrams as a guide ONLY. Study the articles in this issue before deciding on the alarm system you want.

3-INPUT ALARM MODULE

Parts & PC: \$45.00
PC board only: \$6.70

NOTE: Some Schmitt gates are identified as a BUFFER and some as an INVERTER. The name identifies the main purpose of the gate.



If you want a low-cost alarm for home or office, this is where to start. This 3-input alarm module has a number of features — it can be used by itself or combined with other modules described in this book to produce a fully-fledged 4 or 8 sector alarm.

As you will see in a moment, it's the basis of a very powerful system and the reason we have presented it in modular form is so that you can put a system together to suit your own specific requirements.

Many of the low-cost alarms on the market do not have as many features as we are offering such as soft-start siren, panic, piezo siren and smoke detection, while others are over-designed and very complex to set up.

Our original intention was to resell some of the ready-made alarms (such as a 4-sector alarm, 8-sector alarm, dialling alarm, slave dialler etc) to save re-inventing the wheel. But when we saw how poorly designed many of them were, we simply could not recommend them.

I know you are going to say that's an over-statement but it's a fact.

Over the past few years we have fitted a number of different alarms for customers and on each occasion we made particular note of how easy they were to install and the features they contained. In most cases the results were disappointing.

None of them were economically priced. None had easy to understand instructions or clearly identified terminals for the input and output devices. Some did not even have adequate wiring diagrams!

Some looked to be very elaborate and up-to-date but when you had to install them, their poor design really stood out. To give an example, the wiring to the key switch can be a closed loop or open loop.

If the loop needs to be closed to activate the alarm, all you have to do is pull the key switch off the wall and either cut or break the wires and the alarm is turned off. With our design, the contacts need to be open to turn the alarm on so that simply pulling the key switch from the wall will not turn the alarm off — just a small point but one that adds to the effectiveness of an overall design.

Take another case — it took us hours to program one alarm via a key pad due to the incredibly difficult programming sequence. When the purchaser needed to change one of the phone numbers, we had to drive 30km to his house, as it was absolutely impossible to give him instructions over the phone. The alarm (made in USA) was so poorly designed that each digit of the phone number had to be programmed into a specific location in memory. It took us all our ex-

perience and patience, simply to change the phone number! I sincerely hope you never have to work on one of these alarms — it's an absolute night-mare.

Another alarm (a slave dialler) is almost in the same boat. Although it uses the latest technology (double-sided PC board, microcontroller, low price tag etc), we found it extremely difficult to program as it did not have any display and we had no way of telling what values were located in the various memory locations.

It's amazing to see the latest technology in hardware combined with the most primitive of programming. Many programs are so basic that you have to hand-feed each piece of information into memory. What has happened to "user friendly" operation?

EXTRAS YOU WILL NEED:

At the front of this book you will find a 2-page spread showing the 3-INPUT ALARM MODULE and all the other modules you can add to it, along with the input and output devices.

Don't forget, building an alarm from these modules will not only save you money but also provide more features than many other systems on the market.

It's obvious the programmer of these alarms has never given the prototype to someone who has never seen it before and watched them fumble through the setting-up procedure. If he had, he would be highly embarrassed. Many of them contain fiddley, frustrating requirements that complicate the setting up enormously. I'm amazed that thousands of these alarms have been sold. There must be lots of frustrated installers in the market-place.

When we rang one manufacturer and complained about the difficulties in installing their alarm, we were told "they're designed to be installed by experts."

That's ok. Now that we know the situation, we feel perfectly free to present alarms, diallers and a complete range of modules to you without fear of treading on anyone's toes. None of the manufacturers have catered for the hobbyist market and so we have this field completely to ourselves.

So, here we are with the first of our designs.

As already mentioned, we have decided to present it in modular form. This will keep the modules to a manageable size as a complete alarm system can get quite complicated and fault-finding can get very involved. Secondly it keeps costs to a minimum as you only

have to purchase the modules you need.

One thing you will notice in this book is the trouble we have taken to explain everything. We have learnt from the mistakes of others and that's why everything is clearly identified so you can't go wrong.

You will also be pleased with the prices as this will enable you to put a very low-cost system together.

We intend to show that a system such as this can be as good as an expensive set-up if you follow our recommendations.

Much of the effectiveness of an alarm system lies in the correct choice of sensors.

While PIR's are one of the most amazing devices to be invented, they have a limited use in domestic situations.

This may surprise you but we will discuss this in more detail later.

One of the biggest disadvantages of the standard alarm is the need to turn it off

PARTS LIST

- 4 - 1R 1/4watt 5%
- 1 - 180R " Note: 1%
- 1 - 240R " Note: 1%
- 1 - 1k " 5%
- 1 - 2k2 " Note: 1%
- 9 - 4k7 " 5%
- 5 - 10k " "
- 6 - 100k " "
- 1 - 220k " "
- 5 - 1M " "
- 2 - 4M7 " "
- 2 - 2M cermet pots
- 1 - 1n greencap (102)
- 2 - 100n monoblocks (104) .2" spacing
- 3 - 1u 16v electrolytics
- 1 - 10u 16v electrolytic
- 2 - 22u 16v electrolytics
- 2 - 47u 16v electrolytics
- 1 - 100u 16v electrolytic
- 1 - 1000 25v electrolytic
- 5 - 3mm red LEDs
- 1 - 3mm green LED
- 1 - 10mH choke
- 14 - 1N 4148 signal diodes
- 6 - 1N 4002 power diodes
- 1 - BC 338 transistor
- 1 - BD 679 darlington transistor
- 1 - LM 317r National voltage regulator
- 3 - 74c14 Schmitt Trigger IC's
- 3 - 14 pin IC sockets
- 1 - 12v DPDT relay
- 1 - mini piezo diaphragm
- 1 - mini U heatsink
- 1 - nut and bolt
- 1 - 2amp fuse type M205
- 1 - PCB fuse holder type M205
- 1 - 25cm medium duty red wire
- 1 - 25cm medium duty black wire
- 2 - battery terminals
- 2 - 1.5cm heatshrink (red and black)
- 2 - 2-way PCB screw terminals
- 6 - 3-way PCB screw terminals
- 1 - 3-Input Alarm Module PC board

when entering the premises. By selecting the correct sensors, it can be left on all the time and its effectiveness can be increased. This way you don't have to worry about turning it on and off.

By fitting a number of switches around the home, such as in drawers and cup-

boards, you can leave the alarm on while you are at home. The secret to this is to choose drawers etc that are rarely used. When you pick a drawer you must tell the rest of the household. You can then connect a switch such as a magnetic reed switch and wire it back to the alarm. Make sure the drawer is rarely used otherwise it will be very inconvenient, turning the alarm on and off, every time you want a pair of socks!

To help remind you that the drawer is alarmed, it can have a piece of cardboard jammed in the side so that it is difficult to open.

You will find that a burglar will open all the drawers in a room in his search for valuables, so it doesn't matter which drawer you pick.

The advantage of having the alarm on all the time is to catch a particularly nasty type

of burglar. These are the ones we call cat burglars. They enter your house while you are at home and quietly work their way from room to room while you are asleep, watching TV, or even eating a meal!

You can protect yourself from this type

of intruder by installing a sector alarm and turning on those areas you want to protect. But this requires constant re-programming of the alarm as you change from one area of the house to another.

The system we are presenting, while being very simple, is just as effective and only a fraction of the cost.

Another handy detection device is the pressure mat. These can be placed under rugs in a corridor, under the carpet or in an unused room and provided you step over the rug or mat, whenever you are walking around, the alarm will not be activated.

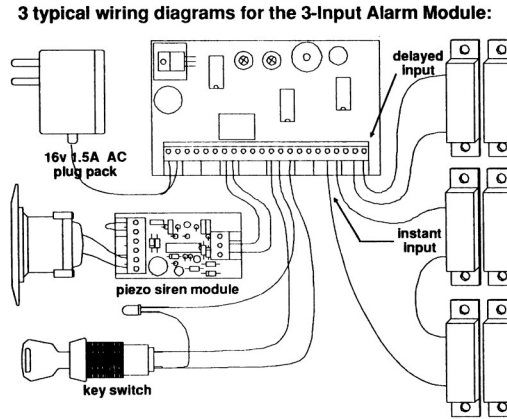
With these types of sensors you can have 24 hour monitoring without having to remember to turn it on and off.

The reason we have not recommended PIR's for this type of set-up is due to them not being able to differentiate between your movements and that of a burglar.

On the other hand, if you like the idea of a PIR, one can be fitted to scan an unused area such as a driveway or back yard or even an area of the house that you don't go near very often.

The only thing to remember is to keep pets away from these areas as a PIR can be easily triggered by movement from these little darlings. You can adjust the scanning of most PIR's to be above the height of a dog or cat but this does not allow for the time when they jump around at play, hunting for flying insects etc.

It boils down to the fact that the hidden switch is the most appropriate sensor for



A minimum system consists of the 3-Input Alarm Module, a 1.5A plug pack, piezo siren module and piezo, key switch to turn alarm on/off, wiring, and three N/C reed switches. Cost \$120.90.

boards, you can leave the alarm on while you are at home.

The secret to this is to choose drawers etc that are rarely used. When you pick a drawer you must tell the rest of the household. You can then connect a switch such as a magnetic reed switch and wire it back to the alarm. Make sure the drawer is rarely used otherwise it will be very inconvenient, turning the alarm on and off, every time you want a pair of socks!

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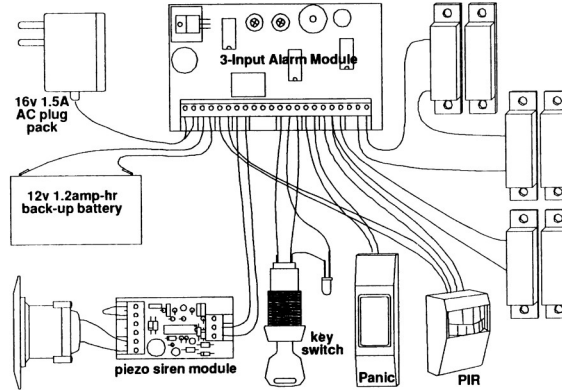


Diagram 2 shows the 3-Input alarm module, back-up battery, 1.5A plug pack, 3 reed switches, 1 PIR, key switch, piezo siren module and piezo, panic button and wiring. Cost: \$221.90

household use.

Provided all the members of the household are aware of the presence and position of the switches, the alarm can be left on continually and you will get 24 hour monitoring.

This 3-input alarm module is ideal for this. It has an INSTANT INPUT and DELAYED INPUT and you can fit any number of switches to either input. In addition, you can add a mixture of normally open and normally closed sensors. You can also add a Current Sensor Module (described in a following article) to the PANIC INPUT so that smoke detectors can be fitted.

THE SMOKE DETECTOR

With our Current Sensor Module you can convert a \$10.00 smoke detector into a \$70 mains-powered detector and get the added benefit of having it trigger a loud siren.

A normal 240v smoke detector costs over \$70 but if the power fails and the back-up battery has not been fitted, it will be useless.

240v smoke detectors are a disaster if you have an Earth Leakage Detector fitted at the meter box. If a fire develops in an electrical appliance, the first thing that happens is the power is cut off by the imbalance of current flowing through the mains wiring. The earth leakage detector trips and you loose all your

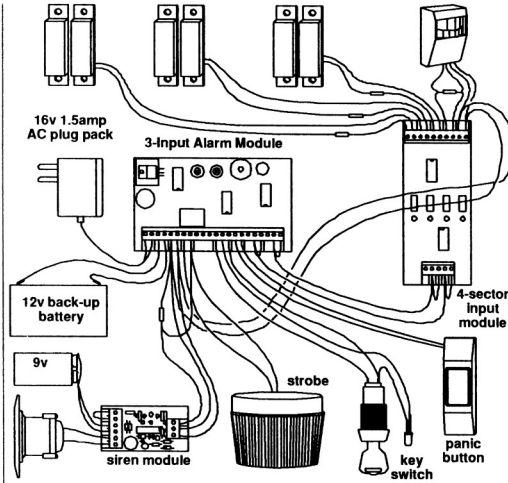


Diagram 3 shows the 3-Input Alarm Module connected to the 4-sector input module, battery-backed siren module, back-up battery for alarm, strobe, panic and key switch.
Cost: \$292.20

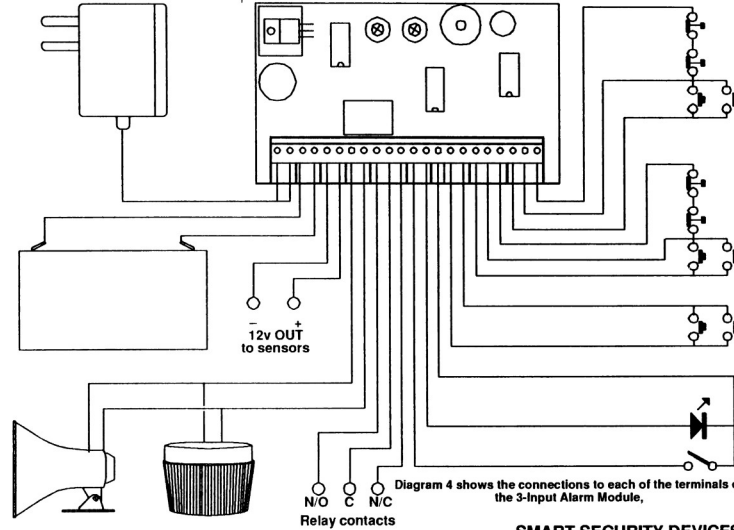


Diagram 4 shows the connections to each of the terminals on the 3-Input Alarm Module,

[One suggestion with Earth Leakage Detectors is to buy the \$35 portable type that plugs into a power point. You can buy one for the bathroom and one for the

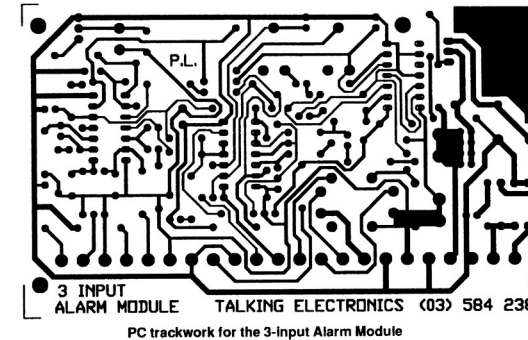
This is the type of set up we are suggesting for the average home as you can cover all the rooms, provide panic as well as smoke detection, all for under

The 4-sector Module will also allow any of the sectors to be turned on or off at any time. An indicator LED will show which sectors are active and if a sector is triggered, the alarm will turn on and the appropriate LED will flash.

Not being a burglar myself, I don't know the routine for rifling a home but I have heard that a thief generally goes through the whole of the house, upturning drawers and cupboards as he goes - it looks like a bomb has hit the place after he has left.

86 This is one of the facts that nearly everyone overlooks. The main reason for 4 and 8 sector alarms is to allow various sectors to be turned on and off to suit the changing movements of the household. These alarms also show which sector has been violated, when an entrance occurs.

It is suggested that all window and door



With our version you can also add a **PANICBUTTON** to the third input (called the panic input) or more than one panic

If you want to protect the wiring from being cut by intruders, you will need to add one of our 4-sector Input Modules. These modules have the feature of monitoring the wiring to each of the sec-

switches be put on the delayed input so that the buzzer on the alarm panel will sound when a switch has been activated. This will give you time to turn off the alarm. If you add a soft-start siren module (to be described in the next book) you will have additional time to turn it off before the full force of the siren wakes the whole neighbourhood.

While you are putting in the wiring for the switches it is strongly recommended that you include at least one smoke detector. Since these devices are so cheap and effective it would be a real tragedy if a fire were to break out for the cost of a \$10 detector.

Our Current Sensor Module will be needed for this and will feed up to 6 detectors and activate the alarm within a few seconds of a detector picking up the presence of carbon particles in the air.

Once you have worked out the number of sensors required, you should consider the option of a soft-start siren. This is available as an add-on module and starts the siren softly so that the noise does not annoy the neighbours.

This is one of the major problems with the old-style alarms and is why they got such a bad name.

A soft-start module costs a little more but is an important inclusion as you can

the key switch.

If you hate carrying keys (like me), you can invest in the Remote Keypad module described in this next article. It allows you to have the arm/disarm feature at the front door and not have to fumble for a key.

FEATURES

Some of the feature of the alarm:

- INSTANT INPUT. This input turns on the siren immediately it is triggered.
- DELAYED INPUT. This input has adjustable delay from 2 to 40 seconds before the siren comes on.
- PANIC INPUT. Detects an input on a 24 hour basis and is always active, even when the alarm is off. The smoke detectors etc are connected to this to get 24 hour coverage.
- INBUILT PIEZO. Indicates delayed input has been triggered. This provides a short period of time so you can turn off the alarm before the siren is activated.
- INBUILT POWER SUPPLY. This charges the back-up battery and will operate the alarm if a back-up battery is not fitted.
- 5 MINUTE TIMER for siren (as required by local law.)

the alarm, there are a number of reasons why it should be included and these outweigh the costs.

If you don't fit a back-up battery you are taking a lot of risks.

As mentioned before, if you have an Earth Leakage Detector fitted at the meter box, the power will go off at the first sign of leakage in an appliance. These switches can also trip during a storm or even while you are away and not only will your alarm run out of back-up battery but you will lose a fridge or freezer full of food.

A burglar can also turn off the power before entering your home and render an alarm inoperative. However most alarms are battery-backed and most burglars know this, so turning off the power will have little effect.

If a back-up battery is not fitted, the output capability of the alarm will be limited by the current capability of the plug pack.

For instance, if you use a 500mA plug pack, you will not be able to drive an 8-watt siren as the output will sound rather funny due to the lack of current. One way around this is to use our piezo driving module BBSM-1P or BBSM-4P. It produces the same sound output as an 8-watt siren but only consumes 35-50mA per piezo.

A strobe consumes about 300mA, so you can see you are severely limited if you don't fit a battery.

If you use a 16v AC 1.5amp plug pack you will be able to drive up to 4 piezos or a single 8watt horn speaker, and a strobe.

But with a back-up battery you can drive up to two 8-watt sirens, a strobe AND have the security of the system working, even if the power is cut off.

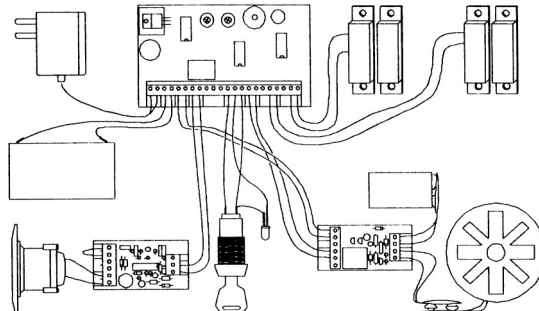
HOW THE CIRCUIT WORKS

THE POWER SUPPLY

The first section we will look at is the power supply.

It uses an LM 317T regulator. This must be a National type as other brands did not shut down to almost zero when the battery voltage reached the 'set-point.' One brand did not turn on after failure of the 240v and the battery had to drop in voltage before the regulator turned on. It took us two days of experimenting to realise the different characteristics of the different chips and this is where some of our design time went to. At least we are now aware of the dangers of putting the wrong chip in the kits.

The LM 317T produces a fixed voltage between its adjust and output terminals and by placing a set of accurate resistors between the output, adjust and negative rail, the regulator can be made to produce a very accurate output voltage.



The 3-Input Alarm Module connected to a smoke detector and smoke detector and piezo siren module. Cost: \$180

test the alarm without frightening anyone.

Some of the last minute things to consider are a metal box for the alarm panel and a remote keypad.

A metal box is a fairly expensive item and I only consider it necessary if you intend to put the alarm in a visible position. If it is placed at the back of a cupboard, for instance, a few items in front of it will hide the panel and you can install an on/off switch nearby to turn the alarm on. This will allow you to do away with

- "Batt charging" LED indicates back-up battery is charging (trickle charging).
- A LED on each input indicates an input is triggered.
- 3 amp relay to operate up to 2 sirens and strobe light.

NO BACK-UP BATTERY?

For those considering not having a back-up battery, here are a few words of warning:

A back-up battery is an essential inclusion. Although it adds to the cost of

We have used 1% resistors for this and even though close-tolerance resistors have been used, the variation in output voltage can be as much as 240mV, depending on the limits of the resistors. We have selected resistors to give a maximum output voltage of 13.6v and by using 1% values, this voltage will be in the range 13.5v to 13.7v due to the tolerance of the resistors. We have selected this voltage to be the most suitable for the size of gel cells we are using. We recommend 1.2 amp-hr or 1.9 amp-hr and this voltage will charge the battery fully, without over-charging it.

The other circuit component to prevent over-charging is the addition of a .25 ohm resistor in the form of four 1 ohm resistors in parallel on the output of the regulator. These limit the charging current to about 500mA when a flat battery is fitted to the module.

They work by creating a voltage drop across them that adds to the fixed 1.25v between the output and adjust terminal of the regulator so that the regulator thinks it has reached a voltage higher than reality and thus the output current is reduced.

If you intend to use a 6.5 amp-hr battery, the maximum charging voltage will have to be higher so that the trickle charge will be proportionately higher.

We are allowing a trickle charge of about 10 - 15mA to keep the battery topped-up. If you use a 6.5amp-hr battery, this can be increased to about 50mA.

When a flat battery is connected to the circuit, the initial charging current will be considerable and will taper off as the voltage of the battery increases.

A sealed lead-acid battery (commonly called a gel cell) has a terminal voltage of 12.6v when it is delivering current but when it is being charged the terminal voltage rises above this. The voltage above 12.6v is called the "floating voltage" and as the battery reaches its fully charged state, this floating voltage can rise to 14.6v. The voltage will only rise to this value if the charging voltage is set to this value or slightly higher.

But if you want to trickle charge the battery, you can set the charging voltage to a lower value so that the current will taper off to a few milliamps and allow the battery to charge over a longer period of time. This will allow the battery to have a much longer life.

If you set the charging voltage too high, the battery will produce a lot of bubbles of gas during the end of its charging cycle and this gas will escape through the bleed holes in the top of the cells.

You may think gel cells are sealed but they have a small bleed hole in each cell to prevent any gases blowing the battery apart. This gas, being hydrogen and oxygen, is electrolysing the water and

effectively removing the H₂O from the cells. This eventually causes the battery to dry out.

That's why it is important not to over-charge them - you don't have any easy way to replace the water.

To prevent the battery overcharging and drying out, we have decided to pre-set the charging voltage via a set of resistors. This will save you setting the charging voltage via a potentiometer as you have to be fairly accurate and most multimeters are simply not accurate enough.

Here is how the charging works:

If a flat battery is connected to the circuit, it will pull the output of the regulator to zero and a current will be delivered by the regulator to begin charging the battery.

The maximum current delivered will be about 500mA due to the inclusion of the 25 ohm resistor.

This current will heat up the regulator considerably and if it rises to more than 150°C, it will start to chop in and out of circuit in an attempt to reduce the overall current.

That's why the regulator only needs a very small heatsink.

As the voltage of the battery rises, the current will reduce and the temperature of the regulator will fall.

The battery will continue to charge and will take about 20 hours to fully charge.

If the alarm goes off when the battery is only partially charged, it will not matter as the circuit uses less than 10% of the capacity of the battery during an alarm condition and there is plenty in reserve.

During charging, the circuit is being supplied by the plug pack so no energy is being drawn from the battery. The current consumption of the alarm in monitoring mode is only about 10mA so that any additional current being supplied by the plug pack will be going into the battery.

THE CIRCUIT

While the battery is charging, the regulator is delivering a voltage to the circuit. Even when the alarm is in the OFF state, all the chips will be operating and any signal from the sensors will be passed through some of the gates. But it will be prevented from reaching the driver transistor via blocking diodes and the alarm will not sound.

This allows the module to be placed in a monitoring mode where INSTANT, DELAYED and PANIC LEDs will indicate the condition of the inputs and only the PANIC input will get through to operate the siren.

Each of these inputs can have one or more sensors connected and this makes the project more versatile than you may first imagine.

The INSTANT and DELAYED inputs

have an additional feature in which BOTH normally open AND normally closed sensors can be connected at the same time. Refer to the accompanying circuits to see how the sensors are connected.

When they are connected, the COMMON terminal and NORMALLY CLOSED (NC) terminal must be joined with a sensor (normally closed sensor) or a jumper link.

This connects the two 100k resistors together to form a voltage divider (with the 1M resistor) to put a LOW on the input of pin 13 of IC1, a Schmitt trigger. A LOW on the input of this gate is any voltage below 30% and the voltage produced by the voltage-divider is about 16%, so the gate sees a low.

This means the output of the gate is HIGH and the Instant LED is not illuminated. Also connected to the output of the gate is a 1u electrolytic. Both ends of this capacitor are at the same potential and thus it is not charged. The purpose of this capacitor is to give a pulse of up to one second to the rest of the circuit, if one of the sensors is left open.

This means that if a sensor is opened and left open, it will only deliver an initial one second pulse. This will allow the alarm to produce an output and turn off. It will require another pulse from the same sensor or another of the sensors to re-trigger the alarm.

Continuing with the circuit we see the input of the second gate (IC1a) is HIGH when in the rest condition and this makes the output pin 10 LOW. On the output of this gate we have a 10k resistor and diode, feeding to the input of another Schmitt trigger IC2i. There are also two other diodes feeding to this input and at the moment we cannot say if the input is HIGH or LOW, due to the effect of these other diodes. We will assume it is LOW so that we can continue with the description. The purpose of the 10k resistor is to allow pin 10 to take pin 13 HIGH if pin 8 of IC2a is not pulling it low via the diode connected directly to its output.

We are now up to pin 13 of IC2i and assuming it to be low due to the 100k connected to the negative rail and we are assuming no signals from the diodes are creating a HIGH condition. Output pin 12 will be HIGH and connected to this output are 4 components that create the 5 minute time delay for the siren. These components produce a very short charge-time for the 22u and a long discharge time.

When the instant input is triggered, a one-second pulse is sent to gate IC2j where pin 12 goes low for one second. This has the effect of charging the 22u electrolytic via the 4k7 and gating diode on pin 12.

Pin 11 of IC2a sees this low and operates the relay via a driver transistor.

When pin 12 goes high, the gating diode and 4k7 resistor do not have any effect on the discharging process and the only component connected to the 47u is a 4M7 resistor. The value of this resistor is designed to take about 5 minutes to discharge the 47u. At this point the sensing gate IC2a will detect a high and turn off the alarm.

Output pin 10 is also connected to the input (pin9) of IC2a with the output of this gate connected to the input of IC2i.

The reason for this is to provide a latch circuit so that the alarm will time-out and not be retriggered by any of the inputs while the 5 minute timing is in operation.

Once the siren has timed-out and reset by the action of the 4M7 discharging the 47u, it can be retriggered again.

This prevents the siren producing a constant wailing, however if a door is flapping in the wind, the circuit will be re-triggered as soon as the circuit times-out.

The operation of the delayed input is identical to the instant input except that a delay section called the ENTRY DELAY has been inserted before the 5 minute timing circuit.

This consists of gates between pins 5, 6 of IC1c and 5, 6 of IC3c. When the delayed input is triggered, an output is produced on pin 4 of IC1b. This charges the 10u on pin 5 of IC1c (providing the alarm is turned ON and the 5-minute timing circuit is not active). This causes pin 6 to go low and the ENTRY DELAY circuit begins to time-out. The 22u on pin 5 of IC3c gradually discharges through the 2M adjustable resistor and 10k stop-resistor. When pin 5 sees a low, pin 6 goes HIGH and this feeds into the 5-minute timing circuit for the siren.

The output of the delay section also does one other thing and we will go back to pin 4 of IC1b where it charges the 10u on pin 5 of IC1c via the 4k7 and diode. When this 10u is charged briefly from the delay section, it remains charged as there is no bleed resistor across it.

This causes pin 6 of IC1c to go low and stay LOW. A diode on this output goes to pin 9 of IC1d, an oscillator and this diode is called a jamming diode. When

the voltage from pin 6 of IC1c is removed, the diode is effectively removed from circuit and the oscillator made up of the gate between pins 9 and 8 is allowed to come into operation and produce a tone that is fed into a BD 679 darlington transistor. This transistor is connected to a piezo and comes into operation as soon as a delayed sensor is triggered. This is the entry delay warning tone.

Only two sections of the circuit remain, the EXIT DELAY and PANIC.

The EXIT DELAY allows the alarm to be turned on via a key or hidden switch so that the user can exit past any of the PIR's or use any of the doors etc without triggering the alarm.

The exit delay is usually set to about 45 seconds however it is adjustable between 0 and 80 seconds. At the end of the exit delay period, the ARMED LED illuminates to indicate the alarm is armed.

When the key switch is turned to the ON position, the 100k resistor on input pin 1 of IC2a pulls the input HIGH and this causes output pin 2 to go low and discharge the 22u electrolytic via the 2M and 10k resistors.

Input pin 3 sees this LOW and causes output 4 to go HIGH to turn on the Armed LED via a 4k7 resistor.

This HIGH is also passed to input pin 5 of IC2c. Output pin 6 goes LOW and the diode on this output ceases to have any effect on input pin 11 of IC2a. The function of this diode is to keep the 22u electrolytic in the 5-minute time-delay discharged so that it cannot charge and turn on the alarm.

The output of the Exit delay circuit also prevents the signal from the INSTANT and DELAYED input from reaching the 5-minute timing circuit.

The last part of the circuit is the PANIC section.

We have already mentioned that all the chips are active when the back-up battery is fitted and the only reason why the signal from either the Instant or Delayed input does not reach the siren circuit is due to jamming diodes.

Since the chips are active all the time, you can see that pushing the panic button will cause the input of gate IC3a to go low and this will make output pin 2 go HIGH. This will turn on the PANIC LED via the 4k7 resistor and at the same time turn on the transistor driving the relay, to operate the siren.

The Panic button charges the 47u electrolytic on pin 1 and this keeps the panic on while the electro discharges through the 4M7 resistor.

If you turn on the panic by mistake, it can be turned off by toggling the on/off switch.

How this works is very clever.

If the on/off switch is off, input pin 1 of IC2a is low and output pin 2 is HIGH. This means the 1u electrolytic will be in a charged condition. By turning the switch ON, input pin 1 will go HIGH and output pin 2 will go LOW. This will put a LOW on input pin 3 of IC3a, a HIGH on output pin 4, a HIGH on input 13 of IC3i and a LOW on output pin 12. The diode on the output of IC3i will not have any effect on the timing section (the 4M7 and 47u) by this action.

But when the switch is turned OFF, input pin 3 goes LOW and output pin 4 goes HIGH, pulling input pin 13 HIGH and through to output pin 12. The 1u takes about 2 seconds to charge and thus the diode on output pin 12 of IC3i delivers a HIGH to the 47u for 2 seconds to charge it. This has the effect of turning off the alarm.

ASSEMBLY

The overlay on the PC board shows exactly where each component is placed.

All the screw terminals are also fully labelled and the function of each LED is shown on the board as is the function of the two trim pots. Each is marked with delay values in seconds. The left one is the ENTRY delay and the right pot is the EXIT delay.

It is very important that everything is fully labelled so that a mistake cannot be made either during assembly or at a later stage.

Some of the alarms we have seen use code numbers or letters for the terminals as they are designed for professional installers. That's why many of them are not suitable for the self-installer and you don't realize this until you get the package home and find how difficult it is to install.

Ours has had a lot of thought put into the layout and overlay to overcome any of these problems.

When you are assembling the components on the board, you have a choice as to how to go about it.

You can either start with the small components such as the resistors and diodes and work up to the large devices such as the capacitors and screw terminals or start at one end of the board and work your way across, fitting each component as you come to it.

It does not matter which method you choose providing you push each component onto the board and solder the leads quickly and cleanly.

We get a number of projects in for repair where one or more of the connections have not been soldered at all.

I cannot believe that someone can put a project together and yet forget to solder a joint.

To prevent this happening, lift the board up to the light and look through it at

RESISTOR COLOURS:

1R brown-black-black
180R brown-grey-black-black-brown
240R red-yellow-black-black-brown
1k brown-black-red
2k2 red-red-black-brown-brown
4k7 yellow-purple-red
10k brown-black-orange
100k brown-black-yellow
220k red-red-yellow
1M brown-black-green

regular intervals. This way you will see if any of the holes have not been soldered.

An alarm is a life-saving product and as such you must put 110% of your concentration into its construction and double-check everything as you go.

The diodes must be fitted so that the line on the body corresponds to the line on the PC board.

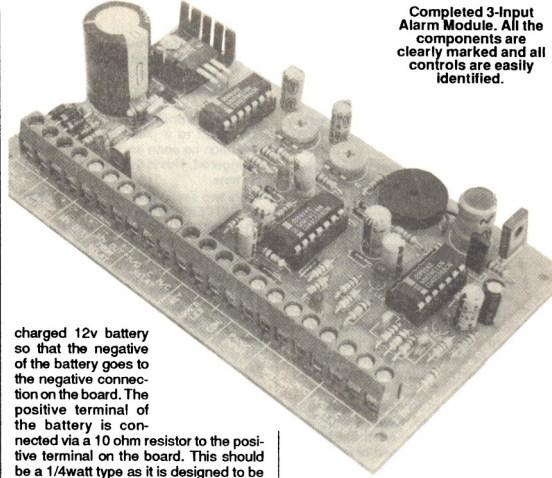
For the power diodes, this line is easy to see as it is a white printed stripe on the body. For the signal diodes, the black band on the body is what we are looking for.

When you come to fitting the three precision resistors for the power supply, you will find them in a separate bag with a note. Each resistor is taped to the note and the values are identified along with the colours. Fit them to the board exactly as shown on the note.

The two terminals for the back-up battery are soldered to the 25cm lengths of med-duty hook-up wire. Start by baring the end of each lead and push the spade on. Keep it in place by bending the fins of the terminal around the insulation. Crimp the terminal onto the wire and solder the connection. Slide the red and black sleeves onto the terminal and shrink with a candle, cigarette lighter or heat-gun.

SETTING UP AND TESTING

When all the components have been fitted and you are satisfied the board is ready for testing, connect the on/off switch, panic button and a reed switch or test switch between the COMMON and NORMALLY CLOSED terminals for both the instant and delayed inputs. These switches must be a normally closed type. Then connect a fully



Completed 3-Input Alarm Module. All the components are clearly marked and all controls are easily identified.

charged 12v battery so that the negative of the battery goes to the negative connection on the board. The positive terminal of the battery is connected via a 10 ohm resistor to the positive terminal on the board. This should be a 1/4watt type as it is designed to be a safety resistor or "fusible resistor" that will burn out if a short is present or if too much current flows.

This is the cheapest and best way to save a project going up in smoke as a gel cell is capable of delivering a very high current and if a short is present on the board, the tracks will very quickly go up in smoke as well as any of the components that are creating the short.

Connect a milliammeter (100mA - 500mA) in series with the 10R resistor to

monitor the current taken by the module as this is how we are going to check each of the sections.

Turn the key switch to the OFF position. None of the LEDs should be illuminated and the current consumption should be less than .25mA.

Leave the project in this state for 10 minutes or so to make sure none of the timing circuits change the conditions.

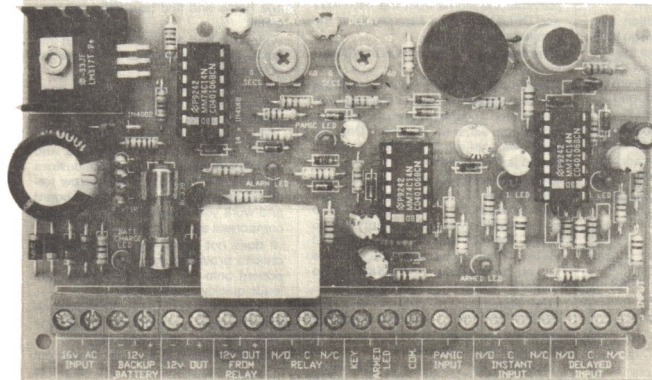
Set the entry and exit delays to minimum time so that all the tests we are going to do, can be done quickly.

Open the instant reed switch by removing the magnet and note the Instant LED comes ON. The current should rise to about 3mA. Close it again and wait a few minutes to make sure the alarm is not triggered.

Repeat with the Delayed input.

Push the Panic button and note the panic LED comes on and at the same time the relay clicks in. The current should rise to about 45mA and the relay should stay on for 5 minutes, as indicated by the ALARM CONDITION LED.

This timing is governed by the 47u and 4M7 near the panic button on the circuit diagram. If the timing is not correct, one or both these



All the screw terminals for the wiring to the 3-Input Alarm Module are clearly marked.

components will need to be checked.

Turn the key switch ON and note the ARMED LED comes on after 0 to 60 seconds. This time corresponds to the marking around the pot on the PC board for the exit delay.

Open and close the INSTANT reed switch and the alarm condition LED will come on for approximately 5 minutes. This time is governed by the 47u and 4M7 near IC₂ and if this timing is not correct, these components should be checked.

When the delayed reed switch is opened and closed, the warning piezo should sound for 0 - 60 seconds as determined by the entry delay setting.

Turn the Entry delay pot fully clockwise and repeat the above to make sure the Entry Delay times-out and corresponds to the value on the board.

Turn the alarm OFF then ON to check the minimum setting for the exit delay and repeat for the maximum time.

Now push the panic button and toggle the key switch to make sure the alarm turns off immediately.

The final section to check is the power supply. To check this you will need a plug pack. Almost any type of plug pack will be suitable if it is in the range 12v-16v AC and with a current rating of 500mA to 1.5A.

We are assuming you are going to use a back-up battery as we have already explained why a back-up battery is essential.

The object of the plug pack is to keep the battery trickle charged and this will be about 10mA for a normal 1.2 ampere-hour battery plus about .5mA to 15mA for the consumption of the alarm. Since this is a very low requirement, almost any plug pack will be suitable. The only thing is the voltage should be 12v - 16v AC, or 16v - 19v if it is a DC plug pack, to take into account the voltage drop across the bridge and voltage regulator.

First we have to make sure the power supply is working and is capable of charging the battery when it is flat or after the alarm has sounded. We must also see that the current tapers off when the battery is charged.

To do this you need to discharge the battery by connecting a high-current car lamp such as a headlight to the battery terminals. Don't short the terminals of the battery together with a screwdriver as it will permanently damage the plates by causing excessive current to flow.

Connect the flattened battery (without the fusible resistor) to the alarm module

and put an ammeter (milliammeter) between the 1000u electrolytic and V_{in} of the regulator. This is the only place you can connect the meter. If you put it in series with one of the battery leads, the slight voltage drop across the meter will upset the charging current.

Turn the plug pack on and feel the regulator with a finger after a few minutes of operation. It will get hot but it has an internal thermal limiting feature to reduce the current to a safe level so don't worry about the small amount of heat-sinking we have provided.

If you are using a 1.5 amp plug pack, you will get a reading of about 500mA charging current for about 15 minutes, when the battery is first connected. This will gradually decrease to 200mA for the next 3 hours and finally drop to 30mA when the battery has reached its fully-charged condition.

This covers all the sections and the module is now ready for fitting into a metal or plastic box, along with any of the other modules described in this book (such as the Current Sensor module).

IF IT DOESN'T WORK

The block diagram for the 3-INPUT ALARM MODULE consists of a number of sections connected by diodes. These blocks are shown in the diagram below: The diodes between the blocks are called gating diodes and their function is to turn a building block on and off by the

When the voltage is removed, the block will operate.

In some instances the reverse is the case. A voltage on one end of the diode will allow the block being gated to operate and removal of the voltage will cause it to freeze.

This gives us a number of different arrangements and to see how a gating diode operates we need to digress a bit and go into the theory of diodes and a few other things.

Firstly we need to see how a time-delay circuit works and how a diode is capable of freezing it.

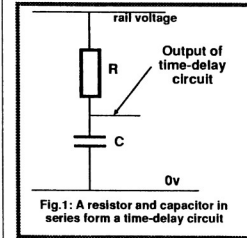


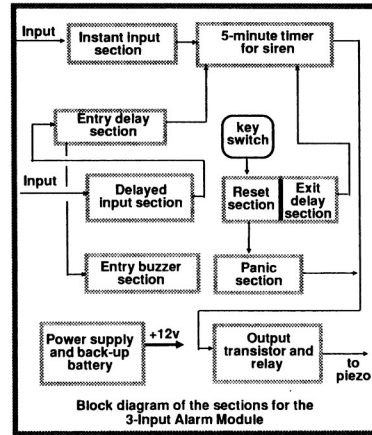
Fig.1: A resistor and capacitor in series form a time-delay circuit

A time delay circuit consists of a capacitor and resistor. These two components can be in parallel or series. We will take the series case as shown in fig 1 above.

When the supply is turned on the capacitor is initially uncharged and it gradually charges to nearly the voltage of the supply over a period of time, via the resistor. The output of a time-delay circuit is taken from the join of the capacitor and resistor.

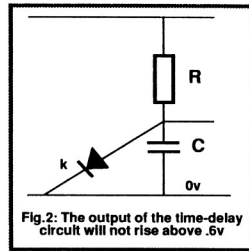
If a diode (as shown in figure 2 on the following page) is placed between the output of the time-delay circuit and ground (0v rail), the voltage on the capacitor will never rise above .6v. This is because the diode is forward-biased and the voltage across a forward-biased diode does not rise above .6v.

If the cathode of the diode is taken to the positive rail, it will not have any effect on the charging of the capacitor as the diode is reverse biased and no current will flow through it. See fig 3. If the capacitor in fig 3 is allowed to charge via the resistor and the diode is taken to the zero volt rail again, any voltage on the capacitor will be removed by the diode



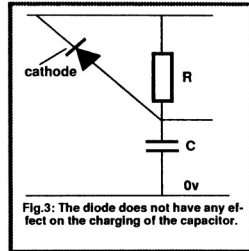
Block diagram of the sections for the 3-Input Alarm Module

application of a voltage. When a voltage is present on one end of the diode, the block being fed by the diode will freeze.



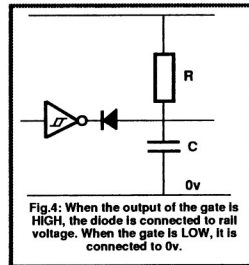
(this will result in .6v appearing on the capacitor).

Instead of manually changing the position of the diode from positive to negative,



tive, we can connect it to the output of a gate. Refer to figure 4. A gate produces a positive voltage when the output is HIGH and a zero voltage when the output is LOW.

When the output of "gate A" is HIGH, it is equivalent to connecting the diode to

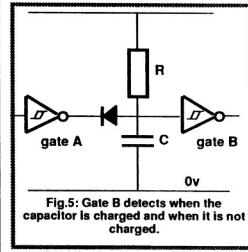


the positive rail.

When the output of the "gate A" is LOW, it is equivalent to connecting the diode to the 0v rail.

If we connect the output of the time-delay circuit to the input of another gate, GATE B as shown in fig 5, we can detect when the capacitor is charged and when it is discharged. The input of this gate has a very high resistance and does not have any effect on the charging or discharging of the capacitor. It is only a DETECTING GATE.

Let's look at what happens to the capacitor in fig 5. When the output of



gate A is HIGH, the diode does not have any effect on the capacitor and we can consider it to be removed from the circuit.

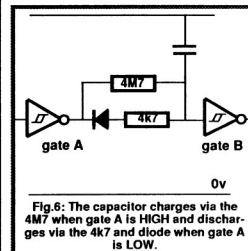
The capacitor charges via the resistor. At the beginning of the cycle, the capacitor is uncharged and gate B sees a LOW.

After a period of time the capacitor is charged to about 70% of rail voltage and gate B sees this as a HIGH.

If the output of "gate A" goes LOW, the capacitor quickly discharges via the diode and gate B sees a LOW.

This is what happens in the Alarm circuit. The only problem is the circuit layout is slightly different to the example we have just given and it may be difficult to see how the two are similar.

Fig 6 shows the 5-minute timing circuit. It works in the reverse to what we have



described above. The 4M7 is designed to discharge the capacitor (electrolytic)

when gate A is HIGH and it charges via the 4K7 and diode when gate A is LOW.

Now you know how the delay section works, you can go back to the circuit and check through it again.

If you found any problems when setting it up, now is the time to isolate it.

To do this you will need a standard multimeter.

The first thing to do is check to see that all components have been fitted correctly, especially the signal diodes. The band at the end of the diode is the cathode and this goes down the hole marked with a LINE on the PC board.

Double-check the value of each resistor with the colour code provided at the beginning of the article.

Read through the article and this time use the multimeter to check each of the readings on the output of the gates. Most of the circuit operates on HIGHS and LOW and these can be detected very easily with a multimeter set to 12v range.

When you come to the delay sections, you have to be more careful as the impedance of the multimeter will upset the voltage on the components.

The only secret I can give here is to set the voltage to a higher reading to increase the impedance of the instrument and make a quick reading, firstly with the negative probe connected to the negative rail and then with the positive probe connected to the positive rail.

This way you will be discharging the capacitor excessively in the first instance and charging it excessively in the second reading so that the true situation will be something between.

CONNECTING A REED SWITCH

You may be worrying if a particular reed switch you have bought is a NORMALLY OPEN type or NORMALLY CLOSED type.

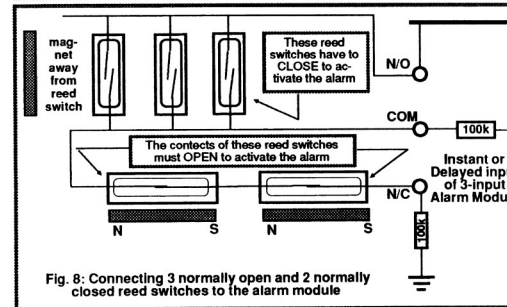
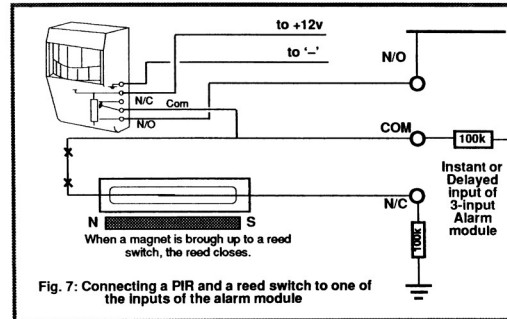
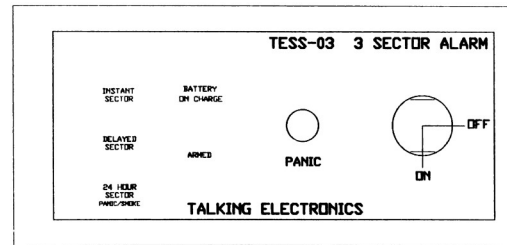
The best way to solve the problem is to test it with a multimeter set to low ohms or the "buzzer test" (on some multimeters), by bringing the magnet up to the switch and removing it to see what happens.

The reeds are made of a soft-iron material that readily accepts magnetic flux but does not retain magnetism. The ends are gold plated so that they make good electrical contact when touching.

The reeds are fitted into a glass tube so that they are separated by a small gap.

When the magnet is brought up to them, the end of one reed becomes north and the other becomes south. This causes the two reeds to touch. When the magnet is removed, the contacts open.

Fig 7 shows a reed switch connected to the normally closed input of an alarm. When the magnet is removed, the contacts will open and the alarm will be triggered.



If you wish to add more of the same type of reed switch to the circuit, you must cut the wiring at point XX in fig 7 and add the additional switches IN SERIES.

You can ALSO add a PIR to the normally open input. The PIR has a relay inside it marked N/O, Com, N/C. Use the Com and N/O contacts and wire them to the input of the alarm. You must also con-

nect the positive and negative of the PIR to the 12v supply on the alarm panel to provide it with power.

Fig. 8 shows 3 open reed switches and 2 closed reed switches connected to the input of the alarm. Bringing a magnet up to any of the open switches will pull the Common HIGH and trigger the alarm.

Removing either magnet from the lower reeds will allow the Common to go high and trigger the alarm.

ALARM BOX

We have produced a metal box for the 3-Input Alarm Module. It measures 29cm x 21cm x 7cm and has a hinged door with cam lock. The cost is \$35.00 including cam lock.

The front of the box has a cut-out so that any of 5 different front panels can be glued to the inside of the door of the alarm box as shown on page 4.

This produces 5 different systems as follows:

3-sector alarm with key switch - TESS-03.

4-sector alarm with key switch - TESS-04

4-sector alarm with key pad - TESS-04K

8-sector alarm with key switch - TESS-08

8-sector alarm with key pad - TESS-08K.

PARTS LIST FOR 3-SECTOR FRONT PANEL

- 4 - 3mm red LEDs
- 1 - 3mm green LED
- 1 - Panic button
- 1 - Key switch
- 1 - 50cm 14 way ribbon cable
- 1 - 3-sector Front Panel (TESS-03)

PARTS LIST FOR 4-SECTOR FRONT PANEL

- 5 - 3mm red LEDs
- 1 - 3mm green LED
- 1 - Panic button
- 1 - Key switch
- 1 - 50cm 16 way ribbon cable
- 1 - 4-sector Front Panel (TESS-04)

PARTS LIST FOR 4-SECTOR FRONT PANEL - KEYPAD VERSION

- 5 - 3mm red LEDs
- 1 - 3mm green LED
- Note: keypad not included. (You need to buy the Remote keypad kit)
- 1 - 50cm 22 way ribbon cable
- 1 - 4-sector Front Panel (TESS-04K)

PARTS LIST FOR 8-SECTOR FRONT PANEL

- 9 - 3mm red LEDs
- 1 - 3mm green LED
- 1 - Panic button
- 1 - Key switch
- 1 - 50cm 24 way ribbon cable
- 1 - 8-sector Front Panel (TESS-08)

**PARTS LIST FOR 8-SECTOR
FRONT PANEL - KEYPAD VERSION**
 9 - 3mm red LEDs
 1 - 3mm green LED
Note: keypad not included. (You
 need to buy the Remote keypad kit)
 1 - 50cm 30 way ribbon cable
 1 - 8-sector Front Panel (TESS-08K)

What you're going to say now is "What's
 the cheapest alarm I can build? . . ."

THE CHEAPEST ALARM SYSTEM

To put together the cheapest alarm,
 here is a list of the items you should buy,
 in order of importance, with their as-
 sociated cost.

It all starts with the 3-Input alarm
 module at \$45.00. Next you will need a
 16v 1.5A plug pack, at \$19.50, a reel of
 4-core security cable at \$40, reed
 switches at \$8.00, Battery Backed Siren
 Module at \$13.20, 1 Piezo tweeter at
 \$11, a switch to turn the alarm on and
 off, and a box to house the modules.

You can then expand it by adding more
 reed switches, a PIR, a smoke detector
 and Current sensor module with 9v
 back-up battery, a 12v back-up battery
 for the alarm panel, a 9v rechargeable
 battery for the siren, a key switch and a
 metal box for the Modules (in place of a
 plastic box) and don't forget the ap-
 propriate front panel.

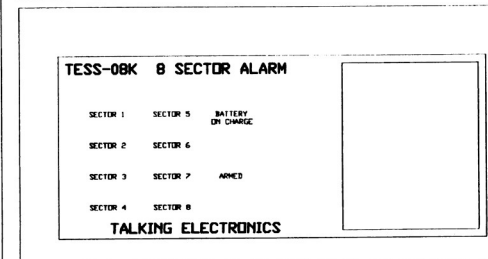
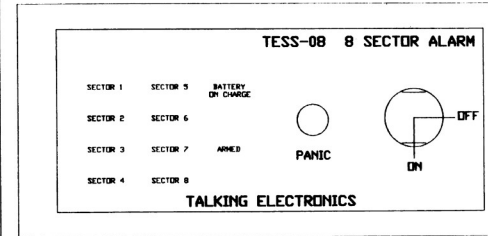
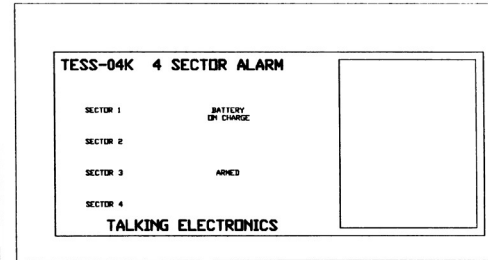
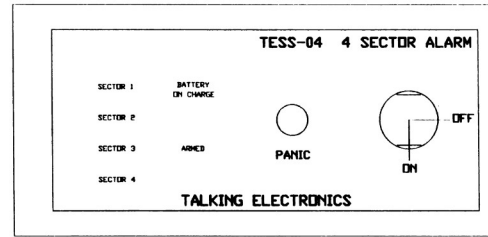
If you want to protect the wiring from
 tampering, you can connect the 4 sector
 Input Module to create a 4 sector system
 or two of the 4-sector modules to create
 an 8-sector system

There are so many combinations for
 you to choose from that it would take a
 full page to provide all the variations.
 It's best to start off simple and add the
 modules as you need them.

That's about it. I have laid the ground
 plan, now it's up to you.

When you buy the \$35 metal box
 for the alarm, you will also have to
 buy one of the front panels to fill
 the cut-out on the door. Refer to
 page 4 to help you decide which
 front panel to choose. These
 panels have been designed to fit
 behind the cut-out and are held in
 position with araldite or other
 strong glue.

With each panel you get the com-
 ponents to fit on to the panel and
 a layout diagram to show you
 where each of the wires connect
 to on the other modules.



PUBLIC DOMAIN SOFTWARE

P.O. Box 486, Cheltenham, 3192. Tel: (03) 584 2386 Fax: (03) 583 1854

Early in 1989, we started with 1,200 disks in our public domain library. The task of writing a catalogue took months, and during that time, the library kept growing. A public domain magazine was promised and subscriptions sold.

Since then, our library has grown to over 20,000 files. With the amount of work we have had on hand, it has been impossible for us to start work on the magazine.

We apologise to those people who have subscribed to the public domain magazine. A credit voucher will be sent to cover the amount we've received.

A short form catalogue of the files we have, has been organised on 3 x 360k or 2 x 720k disks. If you would like a copy of the catalogue disks, please send a stamped self addressed diskette post paid available from Australia Post.

The public domain will now be sold differently. The files will remain in their compressed form to take up less space on a disk. You may choose which type of disk you would like the files to be copied on, and fill that disk with as many files as that disk will hold for a fixed price.

Blank disks can also be purchased if you wish to separate the files from the public domain disk and keep them in their uncompressed form.

There is a minimum of three disks for an order. The prices for the public domain disks and blank disks are shown in the table above.

If you would like to pick up the disks directly from Talking Electronics, the order must be placed one day prior to pick-up.

A lot of people still don't understand the concept of public domain or shareware. We only distribute the software. We know as much about the programs as you do. It would take us years to go through over 20,000 programs and supply a description of each of them.

Most of the programs come complete with manuals or text files describing how to use them. For more information on programs of interest, the author's details are supplied with the program.

The concept is to try the program before you purchase it and if you like it, then you can register the program with the author.

	360kb	720kb	1.2Mb	1.44Mb
3-9	\$6.00 each	\$8.00 each	\$10.00 each	\$12.00 each
10up	\$5.00 each	\$7.00 each	\$8.00 each	\$10.00 each
Blank Disks	\$7.00 Box of 10	\$10.00 Box of 10	\$12.00 box of 10	\$18.00 box of 10
All prices include postage and packing. Min. order: \$18				

In most cases, the author may supply you with an updated copy of the program and even properly printed manuals.

The only catalogue we supply is a short form catalogue with a very brief description for each title.

An order form will be supplied with the catalogue disks. It will also be supplied as a text file on the disks for those who have printers and require more copies.

When you place an order with us, your name will automatically go on a mailing list to receive updates of the catalogue and newsletters. The newsletters will contain comments and reviews of the software.

If anyone would like to send in any comments or reviews on the software, we will gladly publish them in future newsletters. This will make it a lot easier for other people to decide on which programs to order.

Below is a list of our most popular files with a brief description of each. They have been highly recommended by either us or very satisfied customers.

The file size is listed after the title. Work out by the file size what will fit on a disk and list the titles under the heading of "DISK # ?".

Follow the example below:

DISK # 1 Title 1
 Title 2
 Title x
 DISK # 2 Title1
 Title x
 DISK # 3 Title1
 Title 2
 Title x

UTILITIES

SCANV106.ZIP ... 252k
 A great virus scanning program.
 CLEAN106.ZIP ... 234k
 Cleans viruses found by Scanv106.
 VSHLD106.ZIP ... 139k
 Protects your system from viruses.

WSCAN106.ZIP ... 294k
 Windows version of Scanv106.
 PKZ204G.EXE ... 198k
 ARJ230.EXE ... 196k
 LHA212..EXE ... 44k
 File compression/decompression utilities.
 SHEZ86.ZIP ... 188k
 Shell program for archive utilities.

BUSINESS

AEA501C.ZIP ... 332k
 As Easy As powerful spreadsheet.
 FEXP51A.ZIP ... 335k
 File Express V5.1 data base. Disk 1/3.
 FEXP51B.ZIP ... 348k
 File Express V5.1. Disk 2/3.
 FEXP51C.ZIP ... 362k
 File Express V5.1. Disk 3/3.
 PCW305-1.ZIP ... 178k
 PC-Write V3.05 word processor.
 Disk 1/3.
 PCW305-2.ZIP ... 259k
 PC-Write V3.05. Disk 2/3.
 PCW305-3.ZIP ... 228k
 PC-Write V3.05. Disk 3/3.
 QEDIT215.ZIP ... 132k
 Quick Edit V2.15. Text Editor.

GAMES

3D-POOL.ZIP ... 137k
 A very good 3-D pool game.
 X1AGENT.ZIP ... 211k
 Secret Agent game by Apogee.
 XJILL.ZIP ... 311k
 Jill of the Jungle
 CAPT.ZIP ... 166k
 Captain Keen EGA adventure game.
 CD-MAN.ZIP ... 227k
 Very good Pac-Man clone.
 DARTS11.ZIP ... 66k
 EGA darts game with mouse support.
 WOLF.ZIP ... 1309k
 This is, by far, the best shareware game we have ever seen. It is a 3 dimensional game with magnificent scrolling.

Add this:

REMOTE KEYPAD MODULE TO YOUR ALARM

The first thing you are going to say is: "Look at the complexity!"

The reason for this is the layout of the keypad. It is a row-column arrangement (as compared to individually accessed keys) so that some of the simpler circuits you may have seen in other magazines cannot be connected to this type of pad.

We tried to get an individually switched keypad but it was very expensive and difficult to obtain.

Then we investigated the option of using existing keypads kits, but they all had limitations.

One kit did not have a beep to let you know a key had been recognised while another used a microprocessor to do all the work and the kit cost nearly \$70! A bit of an overkill! (Possibly not an overkill but certainly an expensive kit. A 4-bit or 8-bit microcontroller chip is certainly the best way to go and I think our next keypad kit will be microcontroller-based as you only need the chip and a few additional components to do all the work.)

We have seen some really nice professional keypads costing between \$50 - \$70 but this takes away the fun of putting something together yourself.

The project we have presented here has all the features you need and can be fitted to almost any alarm to take the place of a key-switch.

It can also be used in conjunction with a solenoid door lock to produce a key-less lock - for entry into security areas etc.

The output of the circuit is a relay. It requires a 4-digit number to close the relay and the same 4-digit number to open it. There is also a 10-second pulse mode for door strikes. This time can be extended to suit the time required to enter the door before the solenoid turns off.

Each time you press a key, you get a beep to let you know the key has been recognised. And the circuit has lockout. If any more than 8 incorrect pushes are attempted, a three-minute delay comes into operation so that any further pushes are not passed through the circuit.

During this time the beep is deactivated so you know the delay has come into operation. One kit we saw turned the alarm ON if the keypad

detected tampering but this is a silly idea. It merely encourages unwanted strangers to play with the alarm and create a disturbance.

But our circuit has one more feature. It has a delay built into each key-press so that the keys must be pressed at a slow rate. This means that even though the correct number may be entered, it will not be recognised if the keys are pressed too quickly in succession. This adds an extra degree of safety to the system and makes the keypad virtually tamper-proof.

The only thing I can say is the ap-

FEATURES:

- ☐ LOW COST
- ☐ 4-DIGIT SECURITY CODE
- ☐ KEY RECOGNITION BEEP
- ☐ 3-MINUTE LOCKOUT AFTER 8 INCORRECT KEY PRESSES
- ☐ CODE MUST BE ENTERED SLOWLY

pearance of our keypad and its surrounding face-plate is not as flash as some of the commercial designs - they have spent nearly \$50,000 getting a die made for the plastic moulding - but at least you can say you have built it yourself.

With our design, you will have to be satisfied with an electrical-type switch-plate and mounting block or a slim-line project case.

HOW THE CIRCUIT WORKS

Starting at the keypad, you will see the wiring to the keys are connected in a row and column format in which the three columns are tied HIGH via 47k resistors and four rows are tied LOW via 47k resistors.

The output of these 7 lines are given the letters C₁, C₂, C₃ for the columns and R₁, R₂, R₃, R₄ for the rows.

When a key is pressed, a conducting rubber pad under the key touches two carbon tracks on the PC board so that the row and column below the key are connected together.

To explain how the circuit works, we will take the 4-digit number 5678 and show

PARTS AND PC \$29.85

PC Board only: \$4.50

face-plate: \$6.00

Door Strike: \$39.00

how it gets through. We have chosen 5678 in preference to 1234, or any other number, to avoid confusion with "the first, second, third digit" etc.

You will appreciate that the PC board comes uncoded so you can create any 4-digit number you wish. Although a number such as 2222 or 5577 will operate the circuit, it is best to stick to four different digits so that no problems will occur as the circuit goes through its sequence.

One of the things to do during construction is to connect the keypad to the four op-amps via jumper links and diodes as shown in the accompanying set of diagrams so your 4-digit code will go through. We have selected 5678 as our demonstration number and our discussion will revolve around these digits.

So that key 5 will operate the first op-amp (made up of pins 12, 13 14), we need to connect C₂ to C_x and R₂ to R_x.

PARTS LIST

- 1 - 1k
- 1 - 4k7
- 6 - 10k
- 12 - 47k
- 4 - 100k
- 1 - 470k
- 11 - 1M
- 1 - 4M7
- 1 - 1n green cap capacitor (102)
- 2 - 100n monoblock capacitors (104)
- 1 - 220n monoblock capacitor (224)
- 1 - 10u 16v PC mount electrolytic
- 1 - 22u 16v PC mount electrolytic
- 1 - 100u 16v PC mount electrolytic
- 3 - BC 547 transistors
- 1 - BC 557 transistor
- 1 - BC 338 transistor
- 19 - 1N 4148 signal diodes
- 2 - 1N 4002 power diodes
- 1 - 3mm red LED
- 1 - LM 324 Quad op-amp IC
- 1 - 4017 decade counter IC
- 1 - 4518 dual BCD counter IC
- 1 - 74c14 hex Schmitt trigger IC
- 2 - 14 pin IC sockets
- 2 - 16 pin IC sockets
- 1 - mini piezo diaphragm & foam tape
- 1 - 2-way PCB screw terminal
- 1 - 3-way PCB screw terminal
- 1 - 12 key keypad
- 1 - 12v SPDT relay
- 1 - 15cm 8-way ribbon cable
- 1 - piece double sided foam tape
- 4 - 3mm bolts x 32mm long & 12 nuts
- 1 - 50cm fine tinned copper wire

1 - REMOTE KEYPAD PCB

[illegible]

Now we need to know how an op-amp works:

The '+' input of an op-amp must be a few millivolts higher than the '-' for the output to be HIGH. If the '+' is not higher than the '-' the output will be LOW. Let us see what happens when we connect column 2 and row 2 to the inputs of the first op-amp.

Column 2 has a 47k to the positive rail and the line then passes through a forward-biased diode to pin 13. This line then has a 1M resistor to ground. The forward-biased diode will have a voltage across it of about .6v. This means the 47k and 1M resistors form a voltage divider network such that if the supply voltage is 10v, the voltage on the negative input of the op-amp will be about 9v.

The row network has a 1M to the positive rail and 47k plus base-emitter junction of a transistor to ground.

If the rail voltage is 12v, the voltage on the positive input of the op-amp will be about .5v.

Under these conditions the inverting input '-' is higher than the non-inverting input '+' so that the output of the op-amp is LOW.

When key 5 is pressed, the row and column are joined so that R_x and C_x are joined and this means pin 12 is going to be higher than 13 by approximately .6v.

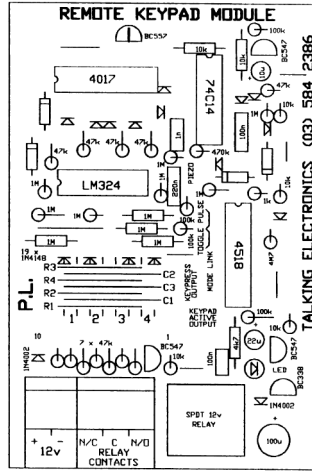
This is sufficient to make the output of the op-amp HIGH. The 47k resistor on output pin 14 will pull a gating diode HIGH so that pin 1 of the 74c14 Schmitt trigger will go HIGH if the first output of the 4017 (Q_0) is also HIGH.

A 220n on pin 1 of the 74c14 prevents glitches getting through and when combined with a 1M across it, provides a time-delay, as you will see in a moment.

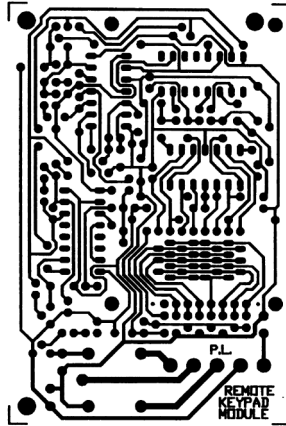
When pin 1 of the 74c14 goes HIGH, pin 2 goes LOW and pulls pin 3 LOW. The output of this gate is pin 4 and it is connected to pin 14, the clock line of the 4017. The pulse into pin 14 causes the chip to count or "clock" on the rising edge of the pulse and the output of the 4017, which was originally Q_0 goes to the second output Q_1 , to make it HIGH.

We now need to look at pin 15, the reset line of the 4017 and see how the circuit resets the chip if an incorrect key is pressed or if ANY key is pressed for longer than about 1/2 second.

One interesting feature of this circuit is its ability to detect if a key has been pressed for more than 0.3 seconds. The circuit resets if this is detected. We use this feature to reset the 4017.



Overlay for the Remote Keypad Module



PC trackwork for the Remote Keypad Module so you can check your board for faults etc.

Press any key for more than 0.3 seconds and the circuit will be reset. The sequence of events that create the reset are quite complicated but put simply the pulse from the key passes through the BC 547 key press transistor, into pin 11 of one of the Schmitt triggers, out pin 10 where it charges a 10u electrolytic (via a diode and resistor) and puts a HIGH on pin 13. Pin 12 goes LOW and turns on a BC 557 to put a HIGH on pin 15, the reset line of the 4017.

This puts a HIGH on the first output of the 4017 (Q_0) pin 3, so that the keypad is ready for operation.

We can now go back to our 4-digit code and see how the numbers pass through the circuit.

Key 5 is wired to the top op-amp and now that pin 3 of the 4017 is HIGH, a HIGH on pin 14 of the op-amp will pass to pin 1 of a Schmitt trigger via a gating diode. The pulse will pass through the two Schmitt triggers (between pins 1&2, 3&4) and clock the 4017 so that pin 2 of the 4017 will go HIGH. This means the first output (pin 3) of the 4017 goes LOW and thus the pulse from the button will be "decked" by the diode on pin 3 and prevented from having any further effect.

The 220n on pin 1 of the Schmitt trigger is fully charged at this stage and begins to discharge through the 1M across it. The time taken for the 220n to discharge to 33% of rail voltage is about 200mS. (I haven't used any mathematics for this as the tolerance of the 220n is +/- 50% or more and I don't want to get into an argument). At 33% of rail voltage the Schmitt trigger sees a LOW and this is when it changes state.

This is when pin 4 of the Second Schmitt trigger goes low and completes the cycle called a "clock cycle."

Not only does pin 4 clock the 4017 during this 200mS time interval but it discharges a 10u electrolytic by turning on a BC 547 transistor across it.

This time interval is independent of how long a key is pressed as the time delay is created by the 220n and 1M resistor.

200mS after pressing the 5 key, the transistor across the 10u is turned off and the 10u is able to be charged via a 10k resistor and diode, provided the key is still pressed.

The 10u takes about 100mS to charge to 66% of rail voltage and when this happens, pin 13 detects a HIGH, making pin 12 go LOW to turn on a BC 557 transistor. This puts a HIGH on the reset line so that even though you have pressed the correct key, you have held it down for longer than 300mS!

The 4017 IC is now reset and the code must be re-entered.

Press key 5 for less than .3 seconds and the 4017 will "clock."

The 4017 is now ready to accept a clock pulse from the second op-amp and if 6 is pressed, the two circuits mentioned above will clock the 4017 and prevent a reset from occurring if the key is pressed

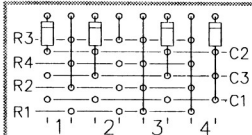


Diagram 1 shows the code number "5931"

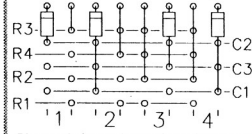


Diagram 2 shows 8'64 as the code number

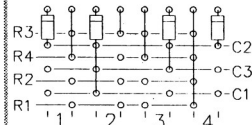
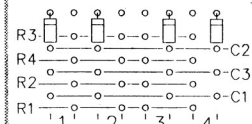


Diagram 3 shows 07#2 as the code number



Use this blank diagram to create your own code number. Refer to the diagrams above to see how the diodes and links are placed on the board. Note: the rows are R1, R2, R4 and R3. The columns are: C1, C2, C3, C4.

for less than 300ms.

The third op-amp (between pins 5, 6 and 7) will process the third digit and the bottom op-amp (between pins 8, 9 and 10) will process the fourth digit.

If this digit is correct, the 4017 will make Q₄ go HIGH. This output does 5 things.

Firstly it puts a HIGH on pin 11 of one of the Schmitt triggers to prevent any further pulses from the keypad resetting the circuit before a timed delay has occurred.

Secondly it starts to charge a 10u electrolytic via a 1M resistor to create a 10-second delay for the pulse option.

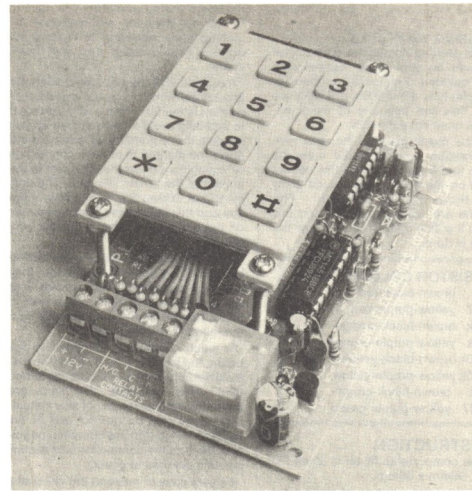


Photo of completed project showing the keypad mounted over the PC board.

Thirdly it provides a pulse output for door strikes etc. Fourthly it provides a clock pulse to toggle the top 4518 to change the state of the relay and fifthly it charges a 22u electrolytic on the key-counting section to reset the counter.

Depending on the mode you have selected on the PC board, (TOGGLE or PULSE) the relay will either change state indefinitely (Toggle Mode) or pull-in for a period of about 10 seconds then release.

The 4518 is a dual BCD counter IC. Each half has been wired differently to get a different result. The top half has been wired in toggle mode to get a toggle effect. This means each clock pulse changes the state of the output.

The other half has been allowed to free-count and by monitoring the highest output we can get a count-to-8.

TOGGLE MODE

For the 4518 to operate in toggle mode, we take the count from the first output. The chip is reset by taking the second output to the reset line.

This means the counter starts at zero and turns ON the first output after the first clock pulse.

After the second clock pulse the first output turns off and the second output goes HIGH. This output is connected to the reset line and so the counter immediately goes to zero. Thus we have no

outputs turned on after the second pulse. After the third clock pulse the first output turns on again and this is how we get the toggle effect.

PULSE MODE

For the pulse mode, the link on the PC board takes Q₄ of the 4017 line directly to the base of the relay driver transistor.

The length of the pulse is determined by the value of the 1M resistor and 10u electrolytic on the Q₄ line.

LOCK-OUT

The other half of the 4518 is used to count the number of incorrect key presses and when this equals eight, a 3-minute lock-out circuit comes into operation.

During the lock-out time, Q₄ of the 4518 goes high and freezes the 4017 via the clock inhibit pin.

The timing circuit is made up of a 4M7 and 22u connected to the reset line of the 4518. When Q₄ goes HIGH it charges the 22u via the 4M7. When the reset line detects a HIGH, the 4518 is reset with Q₄ going low and removing the clock inhibit from the 4017, thus enabling the 4017 and 4518 to accept clock pulses once again.

If the correct code is presented to the circuit, Q₄ of the 4017 goes HIGH and charges the 22u in the 3-minute timing circuit to reset the 4518 so that any count contained within the 4518 will be

removed and counting can start from zero.

ENTERING YOUR CODE

Before starting construction you need to decide on your code number. We have included 3 sample numbers to show you how the diodes and links are fitted. You can use any of these examples or select your own.

Use the fourth diagram for your own code number and to make sure the diodes and links are put in the correct places on the board, you should firstly draw them on the diagram. The columns are not in sequence and this makes it a little difficult to see how the coding is done.

RESISTOR COLOUR CODE:

1k brown-black-red
4k7 yellow-purple-red
10k brown-black-orange
47k yellow-purple-orange
100k brown-black-yellow
470k yellow-purple-yellow
1M brown-black-green
4M7 yellow-purple-green

CONSTRUCTION

All the components fit on a small PC board, 96mm x 66mm.

The value and position of each component is clearly marked on the board and you should have no trouble putting it together.

The first items to fit are the links. There are 8 of these, including the link for the 'mode' (PULSE mode or TOGGLE mode) and four for the code. These are made with the fine tinned copper wire supplied in the kit. Don't forget to fit only the pulse link OR the toggle link.

The next items to fit are the IC sockets, making sure pin 1 on the socket is covering pin 1 on the board. This is important so that you will be able to fit the chips around the correct way at the completion of assembly.

Next fit the rest of the components by starting at one end of the board and gradually working your way across.

Some of the components stand up while others lie down. In all cases the components should be pressed up to the board before soldering to make the project look neat and professional. Because the components are close to

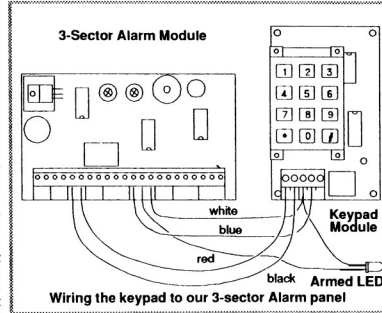
the board during soldering, you have to be careful they are not damaged by making sure soldering is carried out quickly with a clean iron and fresh solder.

The thing that makes the solder run around the wire and create a good connection is the flux. That's why you have to add fresh solder to each joint as you make it. It's no good trying to use the old solder on the iron to make a connection or wiping the iron across the joint in the hope that the solder will stick. The only thing that makes the solder flow is the flux and this only lasts about 5 seconds on the iron as it is turns to vapour very quickly.

When fitting the transistors, they should be pushed up to the board so that they stand the same height as a resistor. This will give them a small length of lead to protect the junction of the transistor from overheating when soldering.

As each component is added to the board, the leads are bent slightly so that it will not fall out when the board is turned over. After soldering, the leads are trimmed with a sharp pair of side cutters. Make sure you do not cut any of the solder or the joint in this operation as you may fracture the connection and this will cause a dry joint to occur.

It's very easy to misread the value of a resistor if you don't know your colour code. We have included a table to help you identify each of the resistors.



The last item to add is the keypad so that the wiring is not fractured during assembly. It is connected to the board via 8-way ribbon cable. This allows the board to be away from the pad if it is difficult to mount the two near each other.

Use the 15cm of 8-way ribbon cable supplied in the kit. Strip the ends carefully and bare each wire with side cutters. If you have a pair of wire strippers,

it will strip all the wires at once.

Tin both ends and fit the wires down holes 2-9, both on the keypad and on the board. Holes 1 and 10 are not used.

The keypad can be mounted on top of the PC board with 4 bolts to fit down the holes in the corner of the pad. The 10cm of ribbon cable will allow you to do this. To position the pad above the board, fit the 4 bolts provided onto the keypad and run the nuts fully up the thread. Use 4 more nuts to space the pad above the board and 4 further nuts to hold the bolts onto the PC board.

Use the small piece of double-sided foam tape supplied to keep the piezo in position on one of the IC's. Use 4-core security cable to connect the module to an alarm panel. Use the red conductor for positive power and black for negative.

If you are going to use the module with one of our alarms, connect the white to 'normally closed' relay contact and blue to 'common.'

This will allow you to turn on the alarm (arm the alarm) when the relay is open.

This gives you the added security of keeping the alarm on if someone cuts the wiring.

CHANGING THE CODE

If you want to change the code, there are two possibilities.

One is to remove and re-position the links and diodes. This is a slow and bothersome operation but will be necessary if you want to change the entire code for some reason.

If you want to have the possibility of changing the code at any time during the life of the keypad, you can fit one or two slide switches on the back of the board so that different numbers can be switched into operation by flicking any of the switches. Two switches for the first two digits will be sufficient as anyone knowing the old code will come to a halt when they find the code no longer operates the door.

This sort of situation only arises when you give the code to a friend for a particular period of time, then wish to change it to preserve your security.

This is even safer than supplying a key as a duplicate can be cut and used at a later date without your knowledge.

IF IT DOESN'T WORK

The circuit consists of quite a number of sections or building blocks and rather than blindly going over the board in the hope of locating a fault, you should try and work out where the fault is coming from, by reading the section on HOW THE CIRCUIT WORKS.

As you know, all the projects have been tried and tested before publication and are guaranteed to work if put together carefully from one of our kits.

Most of the troubles with a non functioning model will be due to faulty soldering or a component fitted in the wrong position or around the wrong way.

Before going too deeply into a fault, it is best to have someone check your completed project against the article and inspect the soldering.

We are surprised at the number of projects that are returned to us with faulty soldering and/or components that have not been fitted or soldered!

Make sure the chips are fitted into the correct sockets and that pin 1 on each chip is covering the mark on the board.

Chips that have been fitted incorrectly may get damaged when the power is applied so don't use it again, buy a new chip and try the old one at a later date.

Make sure the 4 diodes and 4 links have been fitted correctly to create the code you have decided on as per the diagram above.

Once you have exhausted all the simple faults, it's time to use our detailed approach. To do this you will need a

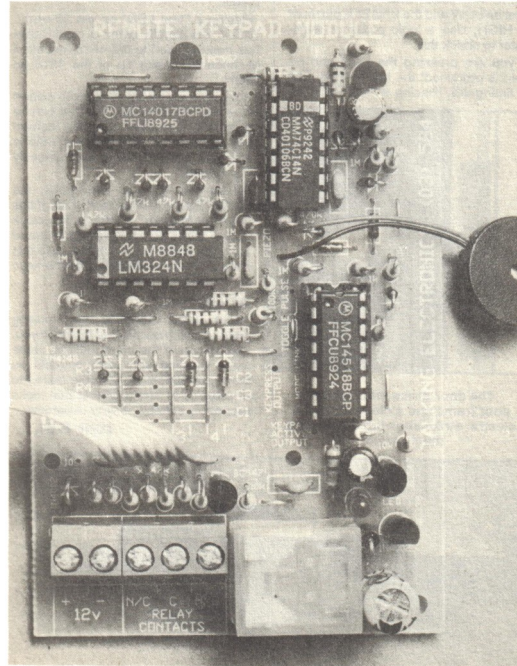
logic probe and/or a number of test LEDs.

A "TEST LED" is a LED on a 10k resistor. You will need these to test the project and the more you add to the board, the more information you will get. You can put 5 on the first five outputs of the 4017 - pins: 3, 2, 4, 7 and 10.

These are placed on each output so that the anode of the LED is connected to the output of the chip and the cathode is connected to the 10k resistor. The other end of the resistor is connected to the negative rail so that when an output goes HIGH, the LED is illuminated. This will let you see the 4017 go through its counting sequence as the numbers are keyed in.

When the circuit is first turned on you have to reset the 4017 by pressing any key for about a second or so. Make sure the LED on pin 3 turns on to prove this.

Before we test the keypad and op-amps, we will check the clocking of the 4017. To do this we take a 10k resistor on jumper leads and place one end on the positive rail.



For the 4017 to clock (that is: go through its sequence of making pin 3 HIGH, then pin 2 HIGH, then pin 4 HIGH, then pin 7 HIGH, then pin 10 HIGH), the reset line (pin 15) must be LOW and the clock inhibit (pin 13) must also be LOW. You can check these with a logic probe or multimeter.

We are now going to check the operation of the 4017 for the first digit. The first digit goes through the op-amp between pins 12, 13, 14 and through a 47k resistor to a gating diode on pin 1 of a Schmitt trigger. Pin 3 of the 4017 is merely designed to allow or prevent the signal passing from the 47k resistor into the gating diode.

When pin 3 is LOW, the signal is prevented from passing into the gating diode. When it is HIGH, the signal is allowed to pass.

With this knowledge, we take the other end of the 10k resistor and touch the track where the 47k resistor (the one from pin 14 of the LM 324) meets the anode of two diodes. This point is marked ① on the circuit diagram. This will make the 4017 increment from pin 3 to pin 2.

If this does not happen, we can conclude that something is preventing the 4017 "clocking."

The fault could lie in the Schmitt triggers between pins 1 and 2 or between pins 3 and 4.

The only way we can inject a signal here is to place the 10k "test resistor" between pin 1 and the positive rail to see if a pulse is passed through to the 4017.

If not, either the 4017 is faulty, the clock inhibit line is not LOW or the reset line is not fully LOW. Tie both the reset and clock inhibit lines LOW via 1k resistors and carry out the above again.

If the 4017 clocks when pin 1 of the 74C14 is taken HIGH, the fault will lie in the gating diode between the two tests.

Once you get the 4017 clocking at test point ①, you can advance to test point ② and then points ③ and ④ so that output pin 10 of the 4017 goes HIGH to clock (toggle) the 4518. If you have wired the driver transistor to the toggle output of the 4518, the relay will click in and the indicator LED on the base of the transistor will turn on.

Repeat the sequence through test points ①, ②, ③, ④ and the relay will turn off. If this does not happen you have to see if the LED on output Q₄ turns on very briefly after the first sequence and also after the second sequence.

This is where you need a logic probe that has a pulse LED, such as our LOGIC PROBE MkII. The pulse LED will let you identify very short pulses. If the clock line is receiving very short pulses, the delay on pin 1 of the 74C14 (the 220n and 1M) is not functioning.

If you are not able to reset the 4017 by pressing a key for an extended period of time, the reset path described above will have to be investigated.

Once you are satisfied the pulses at the test points are getting through, you can check the operation of each op-amp by taking a jumper lead and shorting between R_x and C_x for each of the op-amps.

If this works, the only fault can be in the keypad, the wiring to the pad or the jumper links making up the code number you have chosen.

If shorting R_x and C_x doesn't work, the fault may lie in the op-amps, the diodes on the inverting input being around the wrong way or the value of the resistors on the inputs being incorrect.

NO BEEP?

If the beep does not work when a key is pressed, the first thing to do is remove the two diodes on pin 5 of the 74C14.

This will turn the beep on continually and if not, the fault will lie in the chip, the mini piezo, the 1n or the 470k resistor.

If removing the diodes makes the piezo come on, replace the diode between pins 8 and 5. If this fixes the problem, the other diode is around the wrong way.

If the piezo comes on all the time and stops when a key is pressed, the diode between pins 8 and 5 is around the wrong way.

If the beep does not come on, take pin 9 of the 74C14 HIGH via a 10k (on

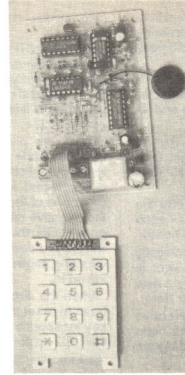
jumper leads). This will make it come on. Now take pin 11 LOW via the same jumper. If this does not create a beep, the chip or the 100n or 1M on pin 9 is faulty.

Finally we can go to the transistor near the keypad and take the base HIGH via a 10k on jumper leads. This will create the beep. If not, the transistor is faulty or the 100k resistor is not connected or the diode on pin 11 is preventing the pulse from getting through.

There's just two more sections to go. The count-to-eight in the lower 4518 and the 3-minute delay.

The count-to-eight is performed by the lower 4518. For the chip to count, the reset line must be LOW and the ENABLE pin must be HIGH. Use a logic probe or multimeter to check this.

If you are pressing the keys and no beep is produced, the lower 4518 may be timing-out. Placing a "test LED" on



The keypad is connected to the PC board via a length of ribbon cable

resets.

Placing a "test LED" on pin 10 of the 74C14 will identify when a clock pulse has been passed to the 4518 and eight of these will make Q_4 of the 4518 go HIGH.

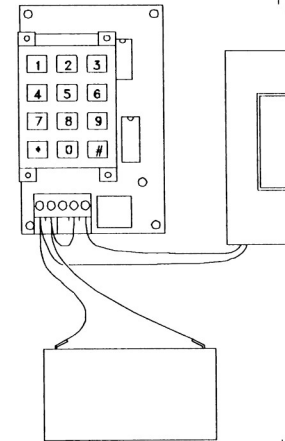
Once the circuit times-out with a short time interval, the delay resistor can be gradually increased until the correct time is obtained. Make sure the diode and 22u are not leaky as previously mentioned.

While the 4518 is timing-out, the ENABLE pin must be kept LOW. If this does not happen, a few more clock pulses will be able to enter the chip and reset the count to zero. Make sure this does not happen by pressing the keys while "time-out" is occurring.

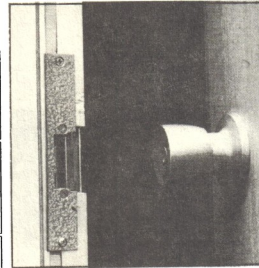
MOUNTING

Most of the mounting and housing problems with our kits are left up to you. This is one of the most difficult areas when building your own projects as there are almost no suitable boxes to put projects in and anything that looks reasonably suitable is very expensive.

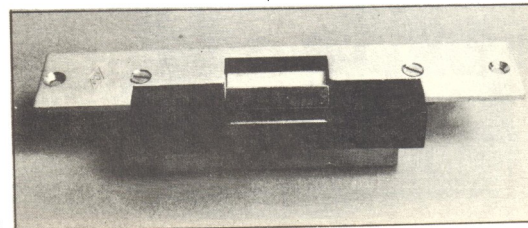
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The door-strike connected to the keypad module and the 12v battery



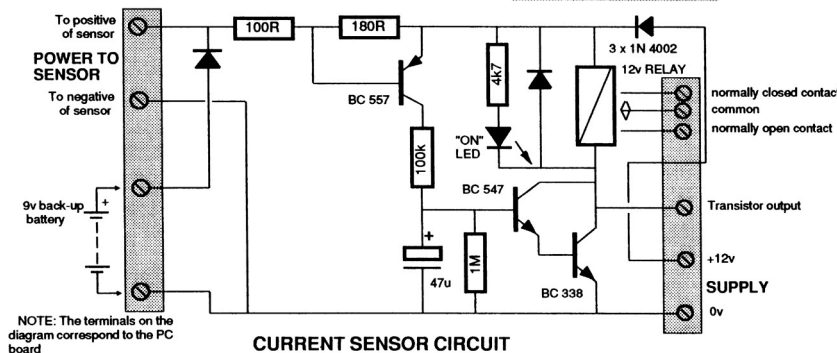
The door-strike mounted on a door frame and a close up of the electric strike showing the release mechanism.



CURRENT SENSOR

Parts & PC: \$11.60
PC board only: \$3.00

Built-up module:
CS-1 \$17.60



CURRENT SENSOR CIRCUIT

This project looks very simple but it performs a very important task. It converts any \$10 smoke detector into a mains powered detector and allows you to connect them to an alarm system.

Some local councils require a mains powered detector to be fitted in the kitchen of all new dwellings and this project allows you to do this.

Up to now, a wired smoke detector has only been available from alarm suppliers or electricians at a cost of about \$100. With this low-cost module you can buy \$10 smoke detectors and connect up to six to a single Current Sensor module and protect the whole house.

This will give you the advantage of the detector going off as well as the loud siren of the main alarm.

You also get the advantage of powering all detectors from the mains, (see article on the following page) or a large back-up battery (in the alarm panel) or a single miniature back-up battery, on the Current Detector itself, and this saves changing individual batteries in the detectors.

You can add this module to almost any existing alarm system or buy a Talking Electronics alarm kit and add it to the input.

HOW A SMOKE DETECTOR WORKS

We are only going to cover the operation of a smoke detector as far as its connection to this module is concerned.

The quiescent (or standby) current of a smoke detector is very small, in the order of a few microamps and at 60 second intervals it tests its own battery by briefly flashing a LED and detecting if the voltage under load is above a certain value. If it is below this value it turns on a circuit to give a brief beep. It does this for about 2 months to give the home owner adequate opportunity to change the battery.

We needed to allow for this characteristic when designing the Current Sensor Module and had to include a delay circuit so that short pulses of current would not trigger the output.

CAPABILITY:
• Connects up to 6 smoke detectors to ANY alarm.

If you put too many smoke detectors on one Sensor Module you run the risk of them testing in turn and overcoming the delay. This will create a false alarm that would be almost impossible to locate. That's why we don't recommend fitting any more than 6.

HOW THE CIRCUIT WORKS

Up to six smoke detectors can be connected to the terminals marked "POWER TO SENSOR." When the current taken by any of them is greater than

PARTS LIST

- 1 - 100R 1/4watt resistor
- 1 - 180R
- 1 - 4k7
- 1 - 100K
- 1 - 1M
- 1 - 47u PC mount 16v electrolytic
- 1 - BC 547 transistor
- 1 - BC 557
- 1 - BC 338
- 3 - 1N 4002 diodes
- 1 - 3mm red LED
- 1 - 12v SPDT relay
- 2 - 2-way connector blocks
- 2 - 3-way connector blocks
- 1 - CURRENT SENSOR PC

Extras:

- 2 - 9v battery snaps
- 1 - 9v back-up battery - alkaline or dry cell.

1mA, the BC 557 transistor turns on and charges the 47u electrolytic via the 100k resistor. When the voltage on the electrolytic is greater than 1.2 volts, the super-alpha transistor, made up of the BC 547 and BC 338, turns on and energises the relay.

The output of the relay can go to an input of an alarm or to a loud siren module or directly to a wailing siren.

The circuit turns on about 1 second after current is detected and remains active while smoke is detected. It turns off about 2 seconds after the smoke detector ceases to detect smoke.

The Current Sensor Module does not detect the brief tests of the smoke detector.

tors, as the electrolytic takes a short time to charge up. However if too many brief beeps occur in succession, the electrolytic will not have time to discharge via the 1M and the circuit may turn on to give a false alarm.

The test button on each smoke detector is still functional and you should go to each detector once a month and test the fact that it is receiving power and is capable of setting off the alarm.

You can do this by placing a burning match or piece of paper under each detector to see how long it takes to respond to the carbon particles in the air.

Or if you are a smoker, you can exhale into the smoke detector and watch it go off.

FITTING OTHER SENSORS

The Current Sensor module is not limited to interfacing smoke detectors. It can connect portable passive infra-red detectors to a main alarm, or any other battery operated device that consumes very little power when in the stand-by mode.

If you have a device that consumes more than 1 milliamp in the quiescent mode, the sensitivity of the module can be decreased by altering the value of the current sensing resistor.

The value of this resistor is presently 180R and when the voltage drop across it reaches .6v, the BC 557 transistor turns on.

Its value, for any sensitivity, is determined by the equation:

$$\text{Current in mA (of the sensor)} = \frac{.6}{\text{resistance of sensor resistor (in ohms)}}$$

For a sensitivity of 5mA, the resistor should be 120R and for 12 milliamps it should be 47R.

REMOVING THE RELAY

If you do not require an isolated output as provided by the contacts of the relay, it can be removed and replaced with a 1k resistor. This will allow the output

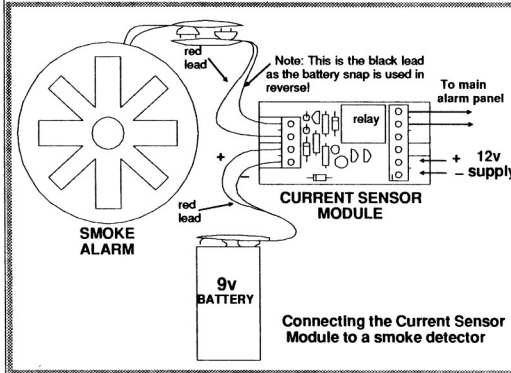
negative rail and the collector of the output transistor.

The diode across the relay can also be removed as it is not required.

FITTING THE PARTS

All the components fit on the PC board with everything identified by the overlay.

The screw terminals must be fitted so that leads can be pushed into the openings and tightened up with the screws provided.



transistor to provide a voltage swing. The output is then taken between the

All the other parts fit close to the board making sure you don't get the transistors in the wrong positions.

The flat on the side of the LED is the cathode and goes down the hole near the relay and the band on the end of the diodes covers the line on the overlay.

Solder all the parts and the board is ready for testing.

TESTING

The completed board should be tested before connecting it to an alarm. To do this, connect 12v to the terminals marked "12v SUPPLY" and make sure the LED does not come on.

Fit a 22k resistor across the input terminals marked POWER TO SENSOR and since this value does not allow 1mA to flow, the LED should not come on. A 10k resistor will allow 1.2mA to flow and since this is just at the point of turn on, the circuit may or may not turn on. Any value below 10k will turn the circuit on. Try 8k2 or 4k7.

Note the delay before the relay closes and the delay after the resistor has been removed. If this occurs, the module is ready for fitting and you should go through the test steps again once it is fitted, to make sure all the wiring is connected correctly.

BEWARE!

I have been alerted to a number of problems with mains powered smoke detectors and earth leakage detectors. You will come across both of these devices when involved with household safety and some interesting stories have been related to me concerning their pitfalls.

On the surface they sound like marvelous Introductions but they have a number of problems.

Some councils require a mains-powered smoke detector to be fitted in the kitchen of all new homes and the rationale behind this is life-long operation without the need to change batteries each year.

But there's a problem. If you also have an earth-leakage detector fitted to the main circuit, you could end up like my friend Phil. Phil is a computer writer in South Australia.

Something went wrong in or around his computer one evening (I think he left a smouldering cigarette on the workbench) and the corner of the bench burst into flames. The flames then engulfed his computer and because he had an earth leakage detector fitted, the lights went out.

Stranded in total darkness he had difficulty finding his way around the house to dial the fire brigade and even more difficulty putting out the fire. The end result is he lost the front of his house and years of work on the computer.

The earth leakage detector failed him as it tripped as soon as about 5 milliamps flowed in the earth line and the power went off just when the smoke detector would have come into operation.

The other problem with earth leakage detectors is their occasional failure during a storm etc or for no apparent reason.

My electrician has told me that he has had to remove a number of them due to false triggering when householders have been away on holidays. They came back to a freezer full of rotten food!

IF IT DOESN'T WORK

For the following tests, connect the 12v supply to the board. If you are using a 12v jell cell, it is best to include a high wattage globe in one of the lines so that if you create a short-circuit on the board when carrying out the tests, the globe will light up and the board will not be damaged.

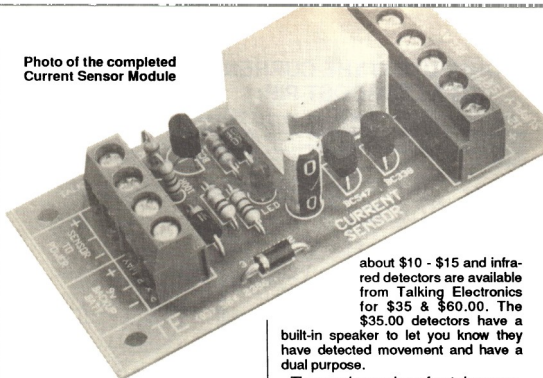
The reason for this is a jell cell will deliver a very high current and will burn out the tracks very quickly if you accidentally create a short circuit.

We will start at the output and work towards the sensor. To check the operation of the relay, short between collector and emitter of the BC 338 transistor. If the relay does not click, the coil may be open circuit. You can measure its resistance with a multimeter. It should be about 200 ohms.

If the relay operates but the LED does not come on, the LED may be around the wrong way or damaged due to too much heat during soldering.

If the delay circuit does not work, the electrolytic may be open-circuit or around the wrong way. Short between the collector and emitter of the BC 557 transistor and the relay will close after about 1 second. If it closes immediately,

Photo of the completed Current Sensor Module



MOUNTING

The Current Sensor Module can be fitted near the main alarm so that only two wires need to be run to each of the sensors. You will also need a 9v battery (a standard type or alkaline type) and a battery-snap for the back-up battery.

The board can be mounted with double sided foam tape or attached with two long bolts and stand-offs.

READY-BUILT UNITS

Current Sensor Modules are also available built-up for alarm installers and for those who do not have the time to construct the board. The ready-built price is \$17.60 and boards

are available without screw terminals and relays for those who are adding them to existing alarms.

Before you buy any of these modules, check the full range of Talking Electronics modules to see if you need any of the other modules.

You will need to read all the articles fully as the capability of each module is more than you expect. We have added extra features to make them the best available.

The devices to support this module are a smoke detector and passive infra-red detector.

Smoke detectors are available at almost any major department store for

about \$10 - \$15 and infra-red detectors are available from Talking Electronics for \$35 & \$60.00. The \$35.00 detectors have a built-in speaker to let you know they have detected movement and have a dual purpose.

They can be used as a front-door warning device in a shop or office (when the main alarm is off) and as a burglar alarm when the main alarm is activated.

If they are placed on the delay input, they can also be used as an early warning device to let you know that the main alarm is activated. This will give you a short time to turn off before the siren starts to sound.

See also our Battery Backed Siren Module project and find out about the advantage of Piezo tweeters in the output to deliver a very high sound level while consuming very little current.

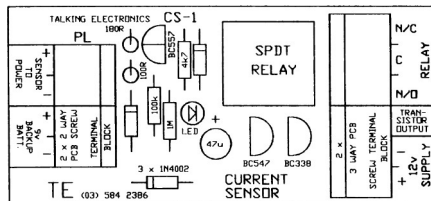
By adding a battery Backed Siren module to your existing alarm, the horn speaker will produce a wailing sound if the wires are cut.

Three different Battery Backed Siren Modules are available:

BBSM-1S drives one 8 watt horn speaker

BBSM-1P drives one piezo tweeter

BBSM-4P is equivalent to a 30 watt siren module and yet it only takes a few watts! It is capable of driving 4 piezo



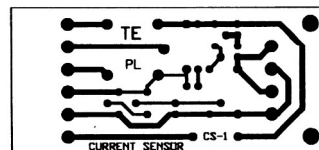
the 47k charging resistor may be the wrong value or the electrolytic may be missing.

If the relay opens as soon as the short is removed, the bleed resistor (1M) may be the wrong value or the electro may not be holding a charge.

If you think the fault is around the BC 547/BC338 combination, you will need a 1k resistor on a jumper lead. Connect the lead to the positive rail and probe the base of the BC 338 with the resistor. The relay should react immediately.

Next take a 10k resistor and probe the base of the BC 547 transistor. Again, the relay should pull-in, but this time the response is slowed-down by the action of the 47uF electro.

Once the delay circuit is working, you can check the BC 557 and sensor resistor as explained above. Values above 10k will not be detected by the circuit while those below 10k will cause the relay to pull in.



Track-work for Current Sensor board

tweeters.

Each module has a built-in wailing circuit and only requires a rechargeable battery (in the form of a 8.4v battery or set of six AA cells) to provide the back-up feature. (Use 6 x AA cells for 4 piezo version.) Refer to the other projects in this book for more details.

CONNECTING THE CURRENT SENSOR MODULE TO A LOW-COST PIR:

The Current Sensor Module can be connected to a low-cost Passive Infrared detector as shown in the diagram below:

To create a low-cost alarm to protect your gold coin collection, or stamp collection, you can connect the Current Sensor Module to the Battery Backed

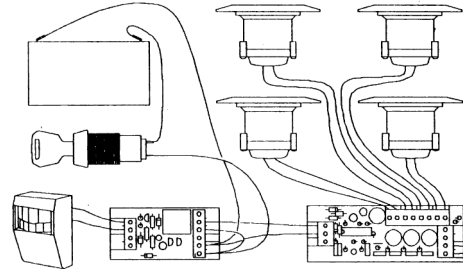


Diagram above shows a low-cost PIR connected to the Current Sensor Module and Battery backed Siren Module to create a low-cost alarm system.

Siren Module featured in the next article and mount a piezo tweeter in each corner of the ceiling.

Since there will not be any entry delay available in this set-up, it will be necessary to have the PIR facing away from the entrance to the room so that a secret switch can be fitted near the door.

Each time you enter the room you will have to remember to turn the alarm off, otherwise you will be greeted with a deafening 110dB siren.

The current consumption for this arrangement is only that required by the PIR (about .25mA) as the current sensor module does not consume any power and the Battery Backed Siren Module does not draw any current until it is turned on by the Current Sensor Module.

Costs can be reduced by using a hidden toggle switch in place of the key switch, 2 lantern batteries in place of the rechargeable 12 battery and 2 piezo tweeters in place of the 4 piezos. This brings it down to about \$120 including wiring and oddments. That's about \$1 per dB and if you have ever suffered a 110dB scream, you'll say it's worth it.

CURRENT LATCH Finds faulty sensors

\$5.70 incl PCB

If you ever experience the annoyance of an alarm going off for no apparent reason, you will appreciate this little project. It's a latching circuit that can be connected to a sensor to determine if the sensor is the cause of the triggering.

This circuit was born out of our need to locate the cause of an annoying activation of one of our alarms, during its test period.

False triggerings are very difficult to locate, especially if they occur at night or infrequently, such as once a week.

They are especially difficult to locate if you have a number of sensors connected to the alarm.

We have used this circuit to locate 2 different false-triggerings in smoke detectors. One detector took excess current about once a day when it was self-testing and the other made funny noises.

PIR's are prone to trigger on windy nights if they are placed outside. They can also be triggered by animals if the sensitivity setting is set too high.

All of these types of faults can be located with this circuit.

It is available as a kit for \$5.70 so keep it in mind if you have trouble with your alarm.

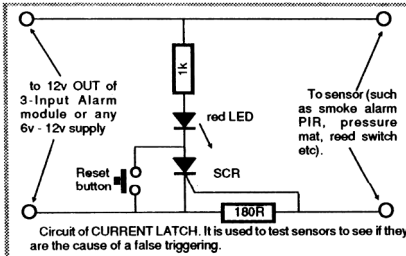
There are two ways to go about finding a faulty sensor. One is to take the sensors off the alarm one-at-a-time and see if the false triggers still persist.

The other is to test the sensors individually with this current latch circuit, or

all at once if you buy one Current Latch for each sensor.

If you have 5 sensors and the fault

the Latch board are connected to a 6v - 12v supply such as the OUT terminals of the 3-Input Alarm Module and the sensor is turned on and left to fault. To test the



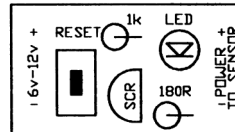
board to make sure it working you can activate the sensor and watch the LED on the PC board come on.

Reset the board and leave it to trigger.

The alternative method is to connect each sensor to the board in turn. This will achieve the same result except it may take a little longer to find the faulty device.

occurs only once a week, it will take up to 5 weeks to locate. With a Current Latch on each sensor, the job will be done in a week.

Take each sensor off the alarm system and connect it to the sensor side of the latch circuit. The other two terminals of



- PARTS LIST**
- 1 - 180R
 - 1 - 1k
 - 1 - 5mm red LED
 - 1 - SCR
 - 1 - PCB push button
 - 1 - Current Latch PCB



BATTERY BACKED SIREN

Parts & PC: \$11.70 speaker version

Parts & PC: \$13.20 piezo version

PC boards only: \$3.00

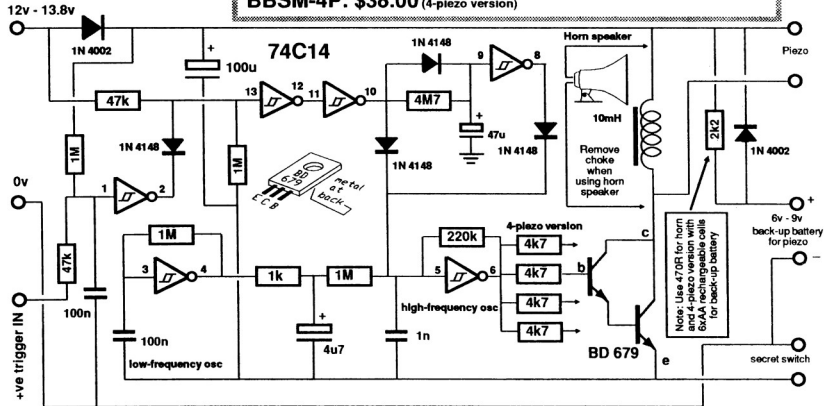
Parts & PC: \$25.60 4-piezo version

PC board only: \$4.00

Built-up Modules:

BBSM-1S: \$25.00 (speaker version) **BBSM-1P: \$25.00** (1-piezo)

BBSM-4P: \$38.00 (4-piezo version)



BATTERY BACKED SIREN CIRCUIT

This module is designed to improve your security by battery-backing the siren.

With most alarms, if the wires to the horn speaker or siren are cut, the alarm goes dead.

But imagine the advantage of the siren turning ON if the wires are cut!

That's the purpose of this module.

It provides added protection by sensing the removal of the power to the horn speaker or piezo tweeter, and sets it into operation.

The module and its back-up battery are mounted in the roof, near the speaker and 3 wires run to it. When any or all of these wires are cut, the siren starts and continues to wail for about 5 minutes.

The Siren Module can be used to drive a horn speaker or piezo tweeter. Both give about the same sound level however the current taken by the piezo transducer is only 30 milliamps while the horn speaker takes about 800 milliamps. The level of sound from the tweeter is considerably harsher than the speaker and anyone knowing the dangers of remaining in the presence of a 110dB sound will depart as soon as possible.

If you use a piezo tweeter, up to 4 can be connected to module type BBSM-4P and the total current will be less than 200mA!

We have designed this module especially for home protection. Since you are not permitted to have any man-traps or

FEATURES:

- Battery-backed circuit
- Drives horn speaker or piezo to 115dB
- Siren sounds when any wires are cut

electrifying devices to disable or arrest any would-be thief, the only solution is to produce levels of sound that the intruder is disoriented by the sheer intensity of the sound.

By using more than one piezo in an installation, it becomes almost impos-

Batteries:

- 1 - 8.4v rechargeable (looks like a 9v transistor battery) \$15.00
1 - 6 x AA cells (with tabs) \$19.00

PARTS LIST

Components common to all 3 modules:

- 1 - 1k 1 - 220k
- 1 - 4k7 4 - 1M
- 2 - 47k 1 - 4M7
- 1 - 1n greenpac
- 2 - 100n monoblocks
- 1 - 4u7 electrolytic 16v PC mount
- 1 - 47u electrolytic 16v PC mount
- 1 - 100u 16v electrolytic
- 4 - 1N 4148 diodes
- 2 - 1N 4002 diodes
- 1 - BD 679 darlington transistor
- 1 - 74c14 Hex Schmitt trigger IC
- 1 - 14 pin IC socket
- 3 - 3-screw PCB terminal blocks

Extra parts for speaker version:

- 1 - 470R
1 - BBSM-1S PC board

Extra parts for 1 piezo version:

- 1 - 2k2
- 1 - 10mH choke
- 1 - **BBSM-1P** PC board

Extra parts for 4 piezo version:

- 1 - 470R 3 - 4k7
3 - 2-screw PCB terminals blocks
3 - BC 679 darlington transistors
4 - 10mH chokes
1 - BBSM-4P PC board
Horn speaker \$16.00 extra
Piezo tweeter \$11.00 extra

The trigger line operates through three inverters and when it is low, input pin 1 is low and output pin 2 is HIGH. The diode on this output does not have any effect on the next gate when pin 2 is high. It only has an effect when pin 2 is LOW.

The HIGH on pin 13 is maintained by the 47k to the positive rail and this makes pin 12 low and pin 10 HIGH.

This HIGH is fed to the input of the high frequency oscillator via a diode and keeps the 1n capacitor charged. This action is called "jamming" the oscillator as pin 6 is low and the 220k resistor is

variable voltage source made up of a 4u7 and 1M, a high frequency oscillator between pins 5 & 6 and a darlington (two transistors in the one package) buffer transistor.

The low-frequency oscillator has a HIGH time of about 1/4 second and the output charges the 4u7 via a 1k resistor. The voltage on this capacitor puts a slight "SET" on the 1n capacitor and changes the frequency of the second oscillator slightly.

When the output of the low-frequency oscillator is low, it discharges the 4u7 to gradually modify the high-frequency os-

across the 4M7. This keeps pin 9 HIGH and pin 8 LOW so that the jamming diode on pin 8 does not come into operation.

When pin 10 goes LOW during an alarm condition, the 47u is gradually discharged via the 4M7 and when pin 9 sees a low, the output of this gate (pin 8) will go HIGH and jam the oscillator.

This will take about 5 minutes and gives the 5 minute time-out as required by some local councils. This time can be reduced by decreasing the 4M7 to 3M3 or lower, depending on the time you require.

The 8.4v back-up battery is kept in a charged condition by being fed by a 2k2 resistor from the 12v supply of the main alarm module. This resistor allows about 2-3mA to flow into the battery during its life-time to keep it charged and the expected life of the battery will be about 12 months as some deterioration will occur due to the constant energy input.

Check the battery every six months or so by placing a small globe across it and seeing how long it illuminates.

CHOOSING THE RIGHT MODULE

Three variations of this module are available:

BBSM-1S drives 1 horn speaker

BBSM-1P drives 1 piezo

BBSM-4P drives 4 piezos

All the modules have the same wailing circuit, back-up feature and time delay. If you already have a horn speaker, you will need the first module. If you are developing a new system I suggest the piezo version as the current requirement of a piezo is very small and you can operate a number of them from a small rechargeable back-up battery.

If you have a collection of gold and silver coins, I suggest the 4-piezo version.

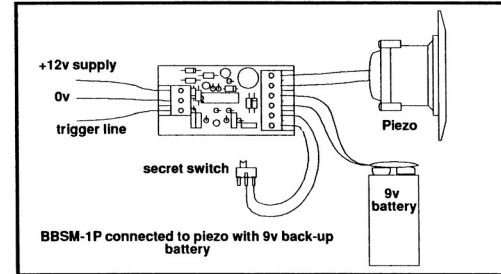
STAND ALONE SIREN

The siren module can also be used by itself or with the Current Sensing module (CS-1) to give a smoke detector a loud output.

The diagram on the previous page shows how to connect the two modules together. Up to six smoke detectors can be connected to one Current Sensor and this will provide both remote indication of the presence of smoke as well as enable a number of detectors to be connected to a central alarm.

This is ideal for large premises such as nursing homes where a number of detectors need to be constantly monitored.

The smoke detector consumes a very small current during its life as it is constantly monitoring the presence of carb-



trying to discharge the 1n capacitor while the diode is keeping it charged.

The super-alpha transistor BD 679 has no voltage on the base and is not turned on.

This is the state of the circuit under quiescent conditions (rest conditions).

When the trigger line goes HIGH, the jamming diode ceases to have an effect and the wailing section comes into operation.

This wailing section consists of a low frequency oscillator made up of a Schmitt trigger between pins 3 & 4, a

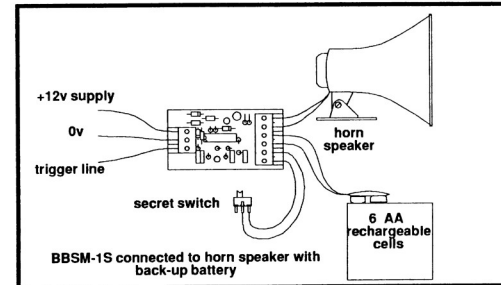
cillator. This gradual change in the frequency of the output is heard as an up/down wailing sound.

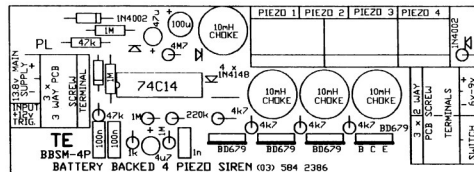
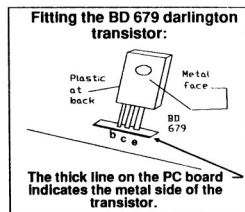
It's a very annoying sound and that's exactly what we want to achieve.

The buffer transistor is a darlington-type with a gain of more than 1,000. This allows an oscillator that has very little driving capability to be connected to a high current load such as a horn speaker.

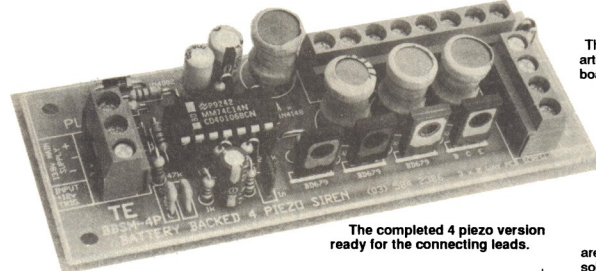
5-MINUTE TIMER SECTION

During the rest-state, pin 10 is HIGH and the 47u in the 5-minute timing section is charged via the diode connected

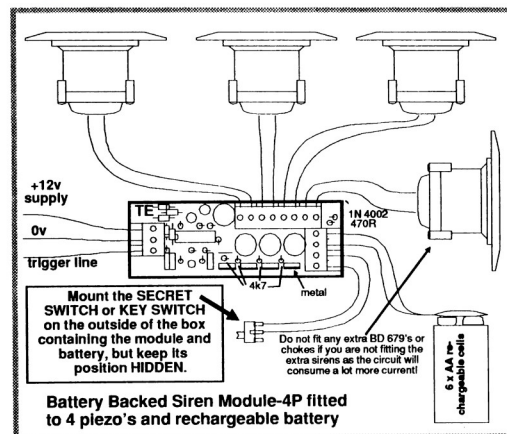




Overlay for the 4-piezo siren board showing the location of all the components



The completed 4 piezo version ready for the connecting leads.



on particles in the air. It also "self-tests" each minute to make sure the battery is in good condition.

The 12v battery for the circuit on page 32 will last more than 12 months. The current taken by the CURRENT SEN-

SOR MODULE is effectively zero while the smoke alarm is monitoring the surrounding air. All smoke detectors incorporate the feature of beeping when the supply voltage is low and this will alert you to the need to charge the battery.

ASSEMBLY

Three boards are covered in this article. They are the horn speaker board, the single piezo board and the 4-piezo board. Choose the board most suitable for your application and follow the assembly instructions.

Everything is identified on the overlay and you must know which way around everything goes to prevent a mistake. Start with the IC socket and then the resistors and capacitors. These are pushed up to the board and soldered quickly to prevent them being overheated.

The diodes and electrolytics are next and then the darlington transistor.

If you are making the piezo version, you will need to add the choke. Finally add the PCB terminal blocks and fit the chip. Make sure pin 1 is at the left-hand end of the socket as shown in the diagrams.

TESTING

Put a slide switch on short leads and connect it to the terminals marked "Switch."

Fit a piezo tweeter to the terminals marked "Piezo" or a horn speaker to the terminals marked "Horn."

Connect a battery snap to the terminals marked "6v - 9v batt back-up" and slide the switch ON. The speaker will emit a wailing sound.

IF IT DOESN'T WORK

Make sure all the parts have been fitted and the IC is not around the wrong way.

The transistor must be a darlington type if you are going to use a horn speaker as it must have a current rating of 1 amp. And it must have a collector-emitter rating of at least 60 volts if you are using a piezo speaker - so we have used a darlington type to meet both criteria.

The quiescent current for any of the modules should be about 0.5mA and if it is greater than this when no output is



Top view of Battery Backed 4-Piezo Siren Module

being produced, you have a fault on the board.

The first thing to do is remove the two diodes on pin 5 of the chip and you will get a tone or wailing from the output. If not, the fault will lie in the gate between pins 5&6, the 1n, 220k, 4k7, BD 679 transistor and/or the speaker (and 10mH choke, if a piezo is fitted).

Measure the voltage on pin 14 of the chip. It should be rail voltage. Next get a mini piezo to act as a "test piezo" and place it between pin 6 and the negative rail. You should only get a very small sound from it, representing the tone of the oscillator. Then try the base of the buffer transistor and negative rail. The output will be even lower but it should be detectable.

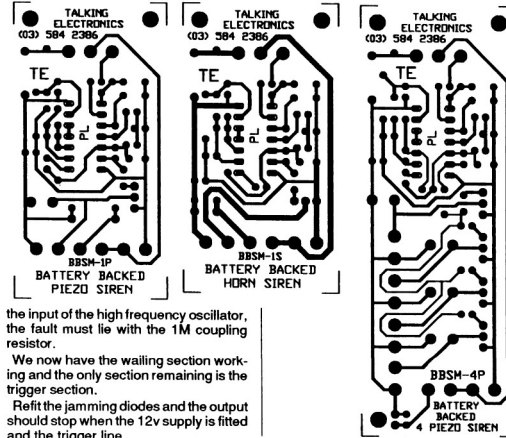
At this stage we have detected the sound up to the base of the driver transistor. To see if the transistor is working we need to have a horn speaker fitted or the 10mH choke in place. These will act as collector load for the transistor as the "test piezo" is a capacitive device and will not allow any DC to appear on the collector.

Place the "test piezo" between collector and emitter. If the oscillator is heard, the only fault is the main piezo has a broken wire inside the piezo itself, or a fault with the piezo diaphragm - which you cannot fix.

If a horn speaker is fitted, the only fault can be poling of the cone, thus preventing it from emitting a sound.

If the tone from the piezo is a wailing sound (when you remove the jamming diodes), both sections of the oscillator are working. If only a constant tone is heard, the fault will lie with the gate between pins 3 & 4, the 100n, 1M, and the voltage storage section made up of the 1k, 4u7 and 1M resistor.

The only way to check the low frequency oscillator is to place a multimeter (set to low volts) on pin 4 and watch the needle flicker. You will see the same flickering effect on the positive lead of the 4u7 and if this is not transferred to



the input of the high frequency oscillator, the fault must lie with the 1M coupling resistor.

We now have the wailing section working and the only section remaining is the trigger section.

Refit the jamming diodes and the output should stop when the 12v supply is fitted and the trigger line is taken LOW.

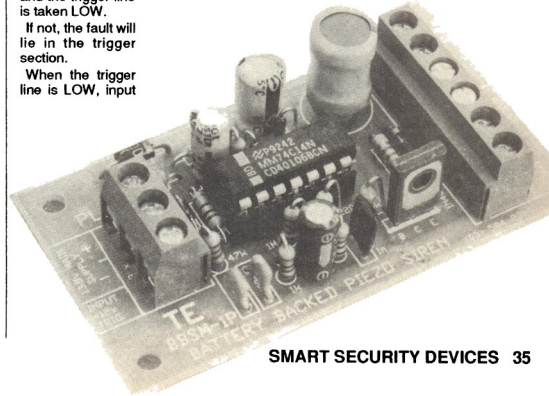
If not, the fault will lie in the trigger section.

When the trigger line is LOW, input

pin 1 should be LOW. This should be tested with a logic probe or high impedance multimeter such as a FET meter as you must not put any load on the lines when testing them.

The easiest way to check the first gate is to measure the output pin 2. It should be HIGH during this condition.

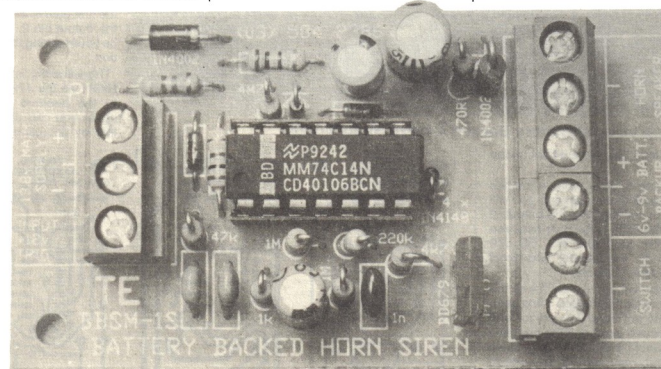
This will allow pin 13 to be HIGH via the 47k resistor to the positive rail and again you can determine this by detecting a LOW



on pin 12. This will create a HIGH on pin 10 and the high will transfer through the jamming diode to the wailing section.

The only section remaining is the 5-minute timer. To test this section quickly you can put a 100k across the 4M7 so that it doesn't take 5 minutes to time-out. If this turns the siren off after a few seconds, you can remove the 100k and

If a fault still alludes you, try changing the chip, checking the soldering and the tracks on the board as well as the supply voltage. It should be a reliable 12v battery and not a plug pack for the test conditions as a plug pack may introduce hum or other irregularity.



check the full time-out. If the circuit does not turn off, the fault may be due to the gate between pins 9 and 8.

Take pin 9 LOW via a jumper lead. If this does not turn the siren off, check that pin 8 is HIGH and try shorting across the diode on pin 8.

If the maximum time is too short, the 47u can be increased to 100u and the 4M7 changed to suit the new value of capacitance.

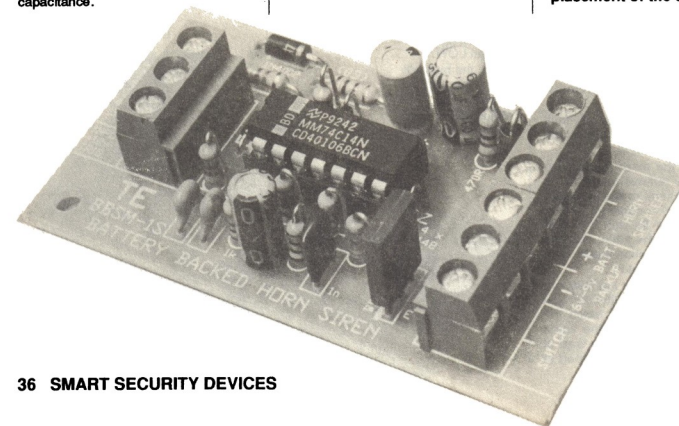
CONCLUSION

This project offers many variations and the three different boards will meet almost any need you may have.

I am sure one of them will suit and you will be really impressed with its effectiveness.

Top view of Battery Backed Horn Siren Module

Close-up of Battery Backed Horn Siren Module showing the placement of the componnets.



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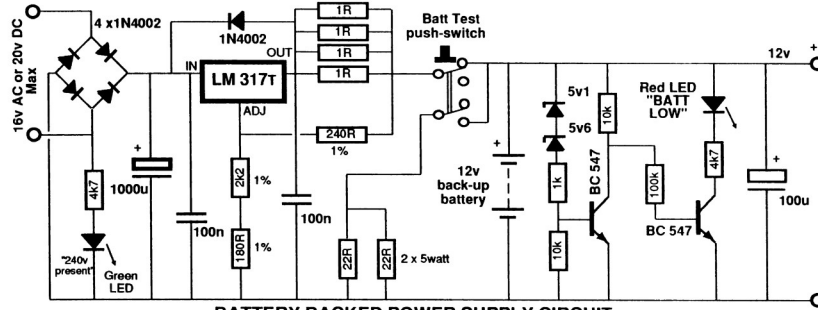
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or M2155 15v AC transformer \$10.95



BATTERY BACKED POWER SUPPLY CIRCUIT

This module is a 1 amp power supply (really about 700mA, due to the limitation of the 1N 4002 diodes and most "1 amp" transformers) and has a battery back-up feature. The circuit also charges and keeps a 12v gel cell fully charged.

When the AC fails, the battery takes over and delivers current to the alarm for a period of time as determined by the amp-hr capacity of the battery.

The circuit also has two additional features. Firstly it has an on-board LED to let you know when the battery voltage is "LOW" and secondly it has a test feature to let you know the condition of the battery.

THE BACK-UP BATTERY

With any alarm system, it is very important to know the condition of the back-up battery and there is only one way to work out how good it is. It must be put under a reasonably heavy load for a period of time.

This is one of the features of this module. It tests the 12v back-up battery at a current of just over 1 amp and the test is done manually for 1 minute by pressing the "battery test" button.

This switch disconnects the regulator from the battery so that none of the front end will be overloaded.

To test the battery, the push-switch is pressed and a finger placed on one of

the 5 watt resistors.

After 10 - 15 seconds the resistor will get hot and after 60 seconds it will be sinking hot. After all, the two resistors will be dissipating 12 watts and if the red LED ("Battery LOW" LED) does not come on, you can be sure the battery has maintained a terminal voltage above 11.3v for the duration of the test.

If the LED comes on, it means one of two things. Either the battery is old and worn out or it is not in a charged condition.

- 700mA power supply with battery back-up.
- Battery-test feature.
- "Batt LOW" indicator.

In a moment we will see why a battery may have deteriorated prematurely but the job is now to charge it and make a further test.

Connect the battery to the module and turn it on. Feel the heatsink on the LM 317T after about 1 minute. It should be

Also Required:
16v AC 1.5amp plug pack \$19.50
or 15v AC 1amp transformer
type M 2155 \$10.95
or 12v AC 500mA plug pack \$17.00
1.2amp-hr battery \$28

PARTS LIST

- 4 - 1R all 1/4watt unless specified
- 2 - 22R 5-watt wire-wound resistors
- 1 - 180R 1%
- 1 - 240R 1%
- 1 - 1k 5%
- 1 - 2k2 1%
- 1 - 4k7 5%
- 2 - 10k 5%
- 1 - 47k 5%
- 1 - 100k 5%
- 2 - 100n monoblock capacitors
- 1 - 100u 25v PC mount electrolytic
- 1 - 1000u 25v PC mount electrolytic
- 5 - 1N 4002 power diodes
- 1 - 5v1 400mW zener diode
- 1 - 5v6 400mW zener diode
- 2 - BC 547 transistors
- 1 - 5mm red LED
- 1 - 5mm green LED
- 1 - LM 317T regulator
- 1 - heatsink for regulator
- 1 - nut and bolt for heatsink
- 1 - DPDT push-switch
- 2 - 3-way PCB screw terminals
- 1 - Battery-backed power-supply PC board

slightly warm. This will indicate a charging current is flowing.

The circuit has been designed with 1% resistors in the charging section so that no adjustment is necessary. Some circuits have a "voltage set" control for

44 SMART SECURITY DEVICES

Under normal situations this is not of great importance as the devices you are powering are generally low-current. This is ok for the stand-by conditions of an alarm but when it is triggered, the current required to power the siren circuit can be considerable (in the order of 800mA to 1.2 amps) and you need to have a plug pack that is capable of supplying the necessary current.

Most alarms draw less than 20mA in

voltage into the regulator will be 18.2v.

The 1.25 amp is also an AC rating and this must be de-rated to 70% (1 amp) to maintain the VA rating of the transformer. These ratings may seem like an over-kill but when you work out the values needed, they are just right.

You should not supply the circuit with a voltage higher than 16v AC or 20v DC as anything above this will be dropped across the regulator and this will cause it to heat up excessively. If the temperature goes over 120°C, the regulator starts to shut down.

This is called thermal shut down and it starts to turn off and on very quickly in an attempt to dissipate less energy. We want to avoid this and that's why we need to look into the dissipation situation beforehand.

If the current taken by the circuit during an alarm condition is 1 amp, the heat lost by the regulator, for each volt appearing across it, will be 1 watt. The heat-sink provided in the kit has a dissipation of 3watts, so you can only allow 3volts. Anything above this will over-heat the regulator when full current is flowing.

The only thing in our favour is the short duration that full current will flow. All modern alarms are timed for a maximum of 5 minutes and even if we allow a dissipation of 4 watts, the heatsink will not allow the regulator to overheat in this short period of time.

But we are assuming that you will be using a back-up battery so the current required for an alarm condition will not be coming from the plug pack but from the battery.

HOW THE CIRCUIT WORKS

The heart of the circuit is an adjustable LM317T voltage regulator that has been set to 13.8v via a set of three accurate resistors. The regulator works by detecting a voltage of exactly 1.25 between the "OUT" and "ADJ." terminals. If we place a resistor between the OUT and ADJ, and another between ADJ and ground, they will form a voltage divider and the output voltage of the regulator will rise until the voltage across the top resistor is exactly 1.25v. The value of these two resistors does not matter, it's the RATIO of their resistance that is extremely critical. More on this will be found in Notebook No 6, when it is printed.

The output of the regulator is used to supply the chips and charge the battery.

The green LED on the bridge indicates 240v Mains is present.

The red LED indicates "BATT LOW" and turns on when the voltage across the back-up battery is less than 11.3v. This voltage is detected by a 10.7v zener diode (made up of a 5.1v and 5.6v) plus the base-emitter voltage of the detecting transistor. When the voltage drops below 11.3v, the zener diodes will no longer conduct and the current through them ceases.

This current keeps the first BC 547 transistor ON and when it is conducting, its collector-emitter voltage is about 0.2v to 0.5v.

This voltage is below that required to turn on the second transistor and thus the LED is not turned on.

But when the current flow ceases, the first transistor is turned off and the second transistor is turned ON via the 10k and 100k resistors on its base. This causes the LED to come on.

We have shown the output voltage of the circuit as 12v but a fully charged gel cell has a terminal voltage of about 12.5v and when it is being charged, the terminal voltage will rise to 13.8v. The battery is kept at this "floating voltage" during its life in the circuit as the LM317T turns on if the voltage drops below this value.

The four parallel 1R resistors have been fitted to limit the charging current to less than 500mA when the battery is flat. They do not have any effect on the charging current once the battery has passed its initial charge-point.

FITTING THE COMPONENTS

All the components fit onto the PC board and everything is clearly marked.

Mount the small components first, taking particular care with the zener diodes. A black band at the end indicates the cathode and this is marked on the board with a line on the overlay.

The two LEDs are next, then the 5 power diodes.

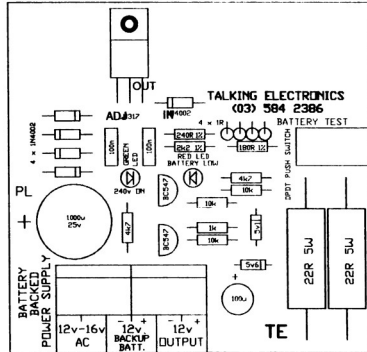
Mount the resistors close to the board; this also applies to the resistors that are standing up.

The three 1% resistors in the power supply are contained in a separate bag in the kit and have a 5-band colour code. The colours for these resistors are as follows:

180R: brown-grey-black-black-brown
240R: red-yellow-black-black-brown
2k2: red-red-black-brown-brown

Next fit the two 100n monoblock capacitors.

Both the transistors are the same type and fit onto the board to cover the outline.



Parts layout for the Battery-Backed Power Supply

the detecting mode and you would think a 300mA plug pack would be ok but when the siren is activated, the current requirement will increase to more than 300mA. If it has a horn speaker siren, the current will be more than 800mA.

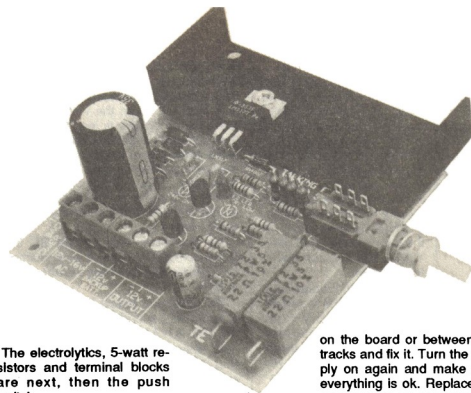
This means the minimum size plug pack is 500mA for a piezo siren and 800mA or 1.5 amp for a horn speaker.

The output voltage of the plug pack is also very important as the regulator requires at least 3v across it, while the bridge drops about 1.4v so the DC input voltage must be at least 18.8v to deliver 13.8v to charge the battery.

A 12v DC plug pack is not suitable as its no-load voltage may be as high as 16-18v but as soon as a load is put on it, the voltage drops to 13 - 14v. And when the full rated current is flowing, the voltage drops to 12v and even lower!

That's why a plug pack is a trap. You have to know its exact specifications, including no-load and full-load voltage. These specifications are rarely supplied and the only solution is to go by our recommendations.

The other thing you must be aware of is AC ratings. If a transformer delivers 14v AC at 1.25 amps, the AC voltage rating will convert to 19.6v when it is connected to a bridge. If we allow a drop of 1.4v across the bridge, the smoothed DC



The electrolytics, 5-watt resistors and terminal blocks are next, then the push switch.

The last component to fit is the LM317T voltage regulator.

Sit the heatsink on the board and fit the three leads of the regulator through the holes. Bend the regulator over so that the fixing bolt can be fitted through the mounting hole. Tighten up the nut then solder the leads. If you don't leave the soldering to last, you may put strain on the leads so that when the regulator heats up, it will expand the leads and push against the soldering. This will create a dry joint and cause lots of problems. Make sure the leads are bent at right angles and don't put any strain on the soldering.

Take the pin out of the push switch so that it is momentary action. The switch must NOT be able to stay on as this will flatten the battery. It must only be a "Test Switch".

The 6 screw terminals are clearly marked but before you fit the board to the alarm system you should test it.

This is how to do it:

TESTING

Connect a 16v 1.5 amp AC plug pack to the 12v - 16v AC terminals. Turn it on and off very quickly and put your finger on each of the parts to see any are getting warm. Repeat this a couple of times and make sure everything stays cold. The green LED should come ON and gradually dim when the power is turned off, but nothing else should happen.

Next, leave it on for a few seconds and see if anything goes up in smoke. This is a very important procedure when testing a circuit that will carry a high current. You must watch the parts very carefully when you turn it on for the first time to see if any smoke is generated. It's no good detecting a smell and wondering what happened.

If something happens, look for a short

on the board or between the tracks and fix it. Turn the supply on again and make sure everything is ok. Replace the component or components

that went up in smoke.

The red LED should not come on during a test procedure and if it does, there is a fault in the BATT LOW section. Short between the collector-emitter terminals of Q₁ with a jumper lead and the LED should go out. If not, the fault lies with Q₂ such as between its collector-emitter terminals.

If the output from the regulator is below 11.3v, the red LED will turn ON. This could be due to a plug pack with a low output voltage and the green LED on the regulator will be able to detect this. If the green LED is not illuminated, the input voltage is too low and you should go to a transformer with a higher output voltage.

Next fit a 12v gel cell to the back-up terminals and turn the supply on. Check the charging current by measuring between the output of the diode bridge and the "IN" of the regulator. You will have to cut the PC track to do this. You cannot measure between the output of the regulator and the battery as the voltage drop you produce across the multimeter will upset the charging current - it is this critical!

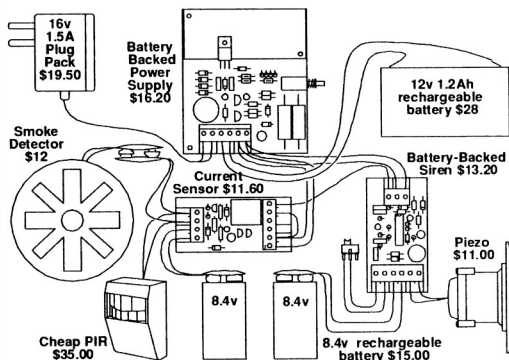
The red LED should not come on when the battery is fitted however it may be in a completely discharged condition and require a few minutes for the terminal voltage to rise - the red LED will illuminate for this period.

Allow the battery to charge for a few hours and test it. If the LED doesn't come on, it is taking a charge and the project is ready for adding to the rest of your alarm system.

MOUNTING

When mounting the board, keep in mind the screw terminals have to be easily accessed and also the push switch must be accessible. Use the mounting holes in the corner of the board and fit it onto stand-offs using nuts and bolts, with the nuts against the board so that it can be removed if required.

See the diagram below for a simple alarm using this module and three others to connect a smoke detector and passive infra-red detector to a loud siren. The module-approach produces a very low-cost system that can be tailored exactly to your requirements.



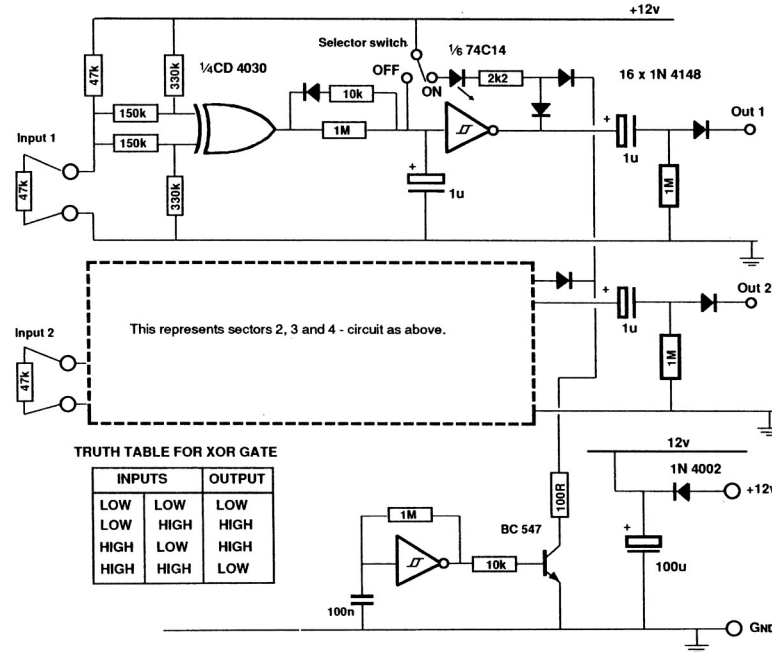
An alarm system for a smoke detector and PIR detector using 3 modules - you will need a few extras such as wiring and switches.

4 SECTOR INPUT MODULE

Protects the wiring between the sensor and alarm module

PARTS AND PC: \$28.20

PC Board only: \$5.30



4-SECTOR INPUT MODULE CIRCUIT

4 sector module with "end of line" (EOL) resistors.

Protects the wiring between the alarm panel and the sensors.

This module can be added to the 3-Input Alarm Module described on page 6 of this issue to produce a 4-sector

PARTS LIST

- | | |
|------------------------------------|------------------------------------|
| 1 - 100R | 1 - 1N 4002 power diode |
| 4 - 2k2 | 1 - BC 547 transistor |
| 5 - 10k | 4 - 5mm red LEDs |
| 8 - 47k (4 for EOL resistors) | 4 - SPDT toggle switches PC mount |
| 8 - 150k | 1 - CD 4030 quad XOR gate |
| 8 - 330k | 1 - 74C14 Hex Schmitt trigger |
| 9 - 1M | 2 - 14 pin IC sockets |
| 1 - 100n | 3 - 2-screw terminal blocks |
| 8 - 1u 25v PC mount electrolytics | 3 - 3-screw terminal blocks |
| 1 - 100u 25v PC mount electrolytic | 1 - 20cm tinned copper wire |
| 16 - 1N 4148 signal diodes | 1 - 4-sector Input Module PC board |

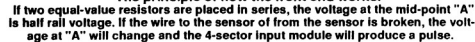
But it was the improvements in operation that made the most difference be-

But first you have to know how to work out the number of sectors you need.

If you look carefully at your plan you will be able to separate it into say three or four areas such as office, front entry, work-room, storage etc or for a house, it



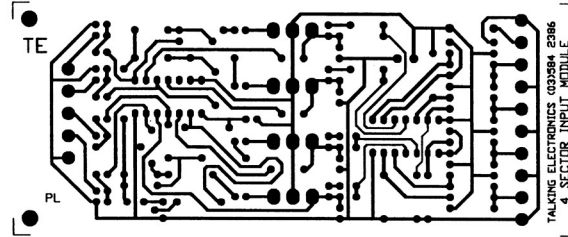
The calculation is quite simple. Draw a plan of the area you wish to cover then separate it into areas such as office, work-room etc. If it is a house, separate



If you aren't good at pretending, hire a burglar for half an hour or so. He will show you exactly how it's done.

The first thing a burglar will do is go around the house to see if anyone is at home or maybe sleeping in one of the rooms.

In the process he will look to see if any rooms have valuables on display, if a member of the household is a collector of stamps, coins, piggy bank money, jewellery etc.



Trackwork for the 4-Sector Input Module

He will then return to the room with the most promise. This is the room you should double-protect.

You will find that most houses have a common passage to most of the rooms and a single sensor will be sufficient.

This is called a "minimum requirement system" but to provide added security for any special rooms, you should install a sensor in the particular room. This will tie up another input.

If you want to cover areas that are not used during an evening, you will need sensors on separate sectors. These are left on all the time and designed to trap a burglar in the act of casing the house. The sensors are placed on windows and doors that are rarely used or in drawers or cupboards that are never opened, so that anyone entering these areas or opening the doors etc will trigger the alarm. Another place for these sensors is on a patio door or window and this will alert you of an attempt to break in. This is quite often the best way of deterring anyone trying to enter as the main line of defence with any break-in is the cover of darkness and the secrecy of silence. Once the cover of silence is broken, the chances of detection are increased enormously.

HOW THE CIRCUIT WORKS

The inherent security of this module lies in the "end of line" resistors on each input.

The way the circuit works is it detect if the resistance (impedance) of the line changes from its pre-set value.

This pre-set value is 47k and comes from a 47k resistor across the lines at the

sensor end.

Across this resistor is placed a normally open switch in the form of a reed switch, relay or pressure mat.

The line is then taken to the input module and connected to another 47k resistor so that the two resistors form a voltage divider.

The voltage at the join of these two

this is detected by a chip on the PC board. If the two wires to the sensor are joined, the potential will change and again the circuit will detect it. The detecting chip on the board is an Exclusive-OR (XOR) gate where four further resistors keep the input lines of the gate at special voltages so that the output is HIGH.

If the sensor is normally closed, we must add the 47k in SERIES with one line as shown in the diagram below.

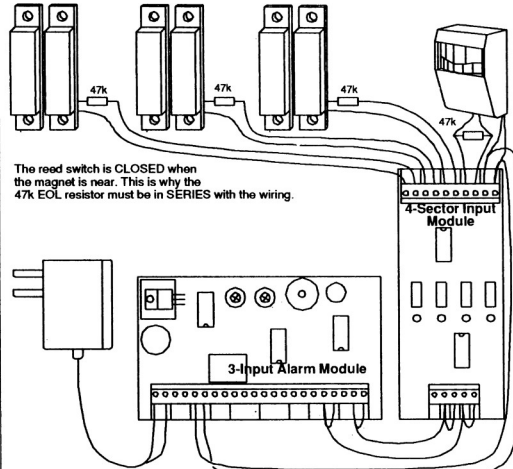
If you look carefully at the set-up between the six input resistors you will find that they are designed to keep the top input line of the gate above half-rail potential and the lower line at below half-rail potential.

When the two inputs are held at different levels like this, the output is HIGH.

If either input changes its voltage level the output goes LOW.

This is what happens if the wires to a sensor are either broken or shorted.

If the wires are broken, the top input of



4-Sector Input Module connected to four devices with the 47k End-Of-Line resistors clearly shown. You will also need to add a piezo siren module, piezo and key switch as show on P8 to complete the test set-up.

the XOR goes slightly higher than previously and does not alter the output of the gate, however the bottom input goes from a LOW state to a HIGH state and causes the output of the gate to change.

If the wires are shorted, the bottom input of the XOR goes slightly lower and does not influence the gate, however the top input goes from a HIGH state to a LOW state and the output changes.

Another feature of this module is very clever. Each sector can be turned on separately and this turns on the "sector LED" to let you know which sectors are active.

If we refer to the circuit diagram we see that the inverter (the Schmitt trigger between pins 9 and 8) has its output LOW under quiescent conditions and the diode on pin 2 is taken low. This means the voltage on the anode of the diode is .6v and so the current path for the LED is through the diode and 2k2 dropper resistor, and it turns ON.

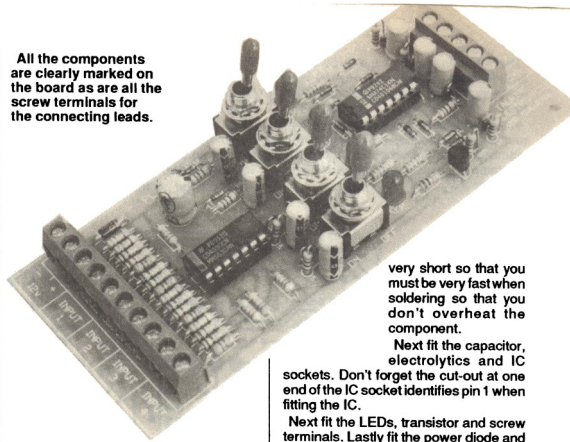
Also connected to the LED is a flashing circuit made up of the inverter between pins 1 and 2 and a BC 547 buffer transistors.

This circuit is operating at all times but its output is prevented from flashing the LED by the shorting action of the inverter between pins 9 and 8 and the diode on its output.

When an intrusion is detected on the input of the alarm, the XOR gate changes state and its output goes LOW. This rapidly discharges the 1u electrolytic via the diode and 10k resistor so that pin 9 of the inverter sees a LOW. This causes the output pin to go HIGH so that the jamming diode on this pin does not inhibit the flashing circuit. The result is the sector LED flashes to indicate a violation and the output of the sector goes HIGH for a short period while the 1u electro charges via a 1M resistor.

The reason for a pulse output is to allow the main panel to deal with the violation and store the result in memory so that it is prepared for a violation on any of the other inputs.

All the components are clearly marked on the board as are all the screw terminals for the connecting leads.



very short so that you must be very fast when soldering so that you don't overheat the component.

Next fit the capacitor, electrolytics and IC sockets. Don't forget the cut-out at one end of the IC socket identifies pin 1 when fitting the IC.

Next fit the LEDs, transistor and screw terminals. Lastly fit the power diode and toggle switches. The switches can be fitted either way around.

Make sure all the soldering is perfect and hold the board up to the light to see if any of the parts have been forgotten. Fit the two IC's to the sockets and the board is ready for testing.

You will have four 47k resistors left over. These are the End Of Line resistors for each of the inputs. They must be placed near the sensor so that the module will provide the protection it is intended to give.

For the purposes of testing the module, they can be fitted to the screw terminals. But they must be re-positioned near the sensors as soon as the sensors are fitted.

TESTING

To test this module you will need the 3-Input Alarm Module, Siren Module, Piezo and plug pack, connected as shown on Page 49.

If any of the outputs of the module remain HIGH, it would prevent the main panel from detecting further intrusions and you would not be able to get multiple sector violations.

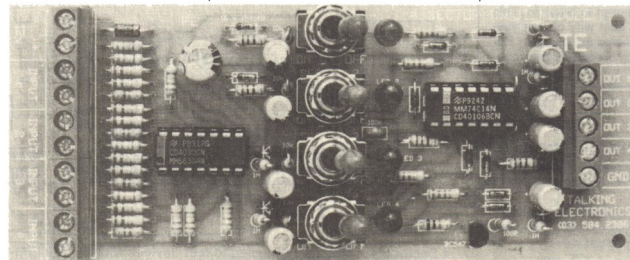
CONSTRUCTION

As with all our modules, all the components fit on the PC board and everything is clearly labelled.

The first thing to do is fit the four tinned copper wire jumper links. Now you can start with the resistors and diodes, making sure the value of each resistor is correct as they cover the value on the board and the only way to check your layout after they are fitted is to refer to the diagram on page 48.

Some of the diodes stand on-end and as with all the components, they are pushed firmly against the board before soldering.

This makes the distance between the solder connection and the component



Completed 4-Sector Input Module showing the placement of all the component on the board.

The four 47k End Of Line resistors should be connected to the screw terminals for this test.

Click the four toggle switches to the ON position. The output of the XOR gate will be HIGH, making the input of the Schmitt 74C14 HIGH after a few seconds. The output of this gate will be LOW, causing the LED to come on via the 2k2 resistor and diode.

The low-frequency oscillator, made up of another Schmitt gate, 1M and 100n is designed to flash the LED when an input is violated. This oscillator is buffered by a BC 547 transistor to provide sufficient driving power to flash 1, 2, 3 or 4 LEDs.

When the two wires of an input are either shorted together or cut, the input of the XOR gate changes and both inputs will see either a LOW or HIGH. By referring to the truth table on page 47, we see the output will go LOW whenever both inputs are either high or low and this will discharge the 1u on the input of the Schmitt gate via the 10k and diode.

This will cause the output of the gate to go HIGH and effectively turn off the LED. The low-frequency oscillator will now take over and flash the LED to let you know which input has been violated.

At the same time a pulse will go to the 3-Input Alarm Module via a 1u and signal

diode. The alarm module will turn on the piezo siren module for 5 minutes to show that everything is working correctly.

To test the input module, short across each of the 47k resistors in turn and make sure the corresponding LED flashes.

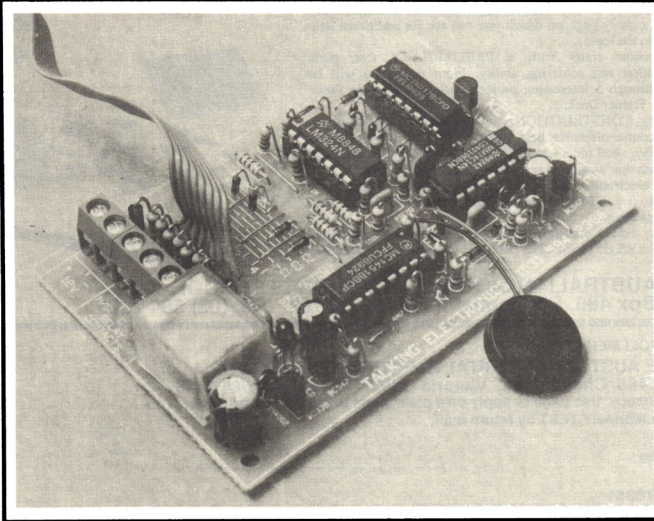
Next remove one end of each 47k resistor and see that the same result occurs.

Try all sorts of different combinations to make sure the module will respond to anything that is likely to occur. Once you are satisfied the module is operating correctly, you can add it to your system.

TE

REMOTE KEYPAD MODULE

The keypad removed, showing the links and diodes for the 4-digit code



... from Page 26.

Such is the case with this kit.

The only solution we have come up with is an electrical face-plate that has a rectangular cut-out to take the keypad.

This can be mounted on the wall with a couple of screws and a slot cut in the plaster-board to allow the PC board to be put into the wall cavity.

You will need about 5-10cm of ribbon cable between the keypad and PC board so you can put the board into the cavity. You can then run 4 wires to the alarm panel.

If you want to mount the keypad and PC

board on the surface of a wall such as a brick wall or panel wall, you can use a slim-line project box.

One half can be screwed to the wall and the PC board fitted inside. The two halves can then be glued together and the keypad fitted into a cut-out on the other half of the box.

It is not suggested that the keypad be placed on an outside wall if there is any way the pad or face-plate can be removed from the wall by an intruder.

USING A DOOR STRIKE

If the keypad can be made attack-resistant, it will make an ideal way of entering

a door without the need for a key.

You will need to install a 12v solenoid door striker so that the door can be opened when the correct code is entered.

The circuit is wired to give a pulse output of about 10 seconds so that the relay will energise the door strike to give you sufficient time to push the door open before the solenoid releases.

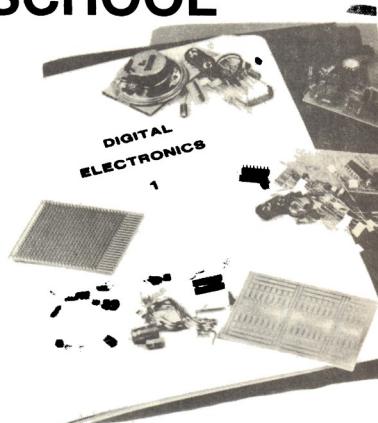
If 10 seconds is not sufficient, either the 1M or 10u on output Q₄ of the 4017 can be increased. You can use either 2M2 or 22u to get about 20 seconds delay.

TE

THE AUSTRALIAN DIGITAL ELECTRONICS SCHOOL

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Name: _____

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() Please send lesson 1 COD. I will pay the postman \$36.00.

You can order 1, 2, 3, 4, 5 or 6 lessons or pay for one lesson at a time.

Please debit my credit card: \$ _____

[illegible]

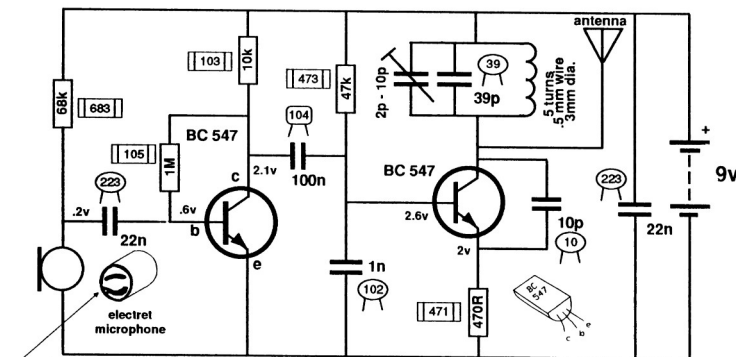
VOYAGER-MkII

AN UPDATE ARTICLE

Parts & PC \$10.50

PC Board (only) \$2.50

The LED Power Meter will help in testing the output of this bug - but it is not essential.



VOYAGER - MkII CIRCUIT

This is an update article on the Voyager to coincide with the new cad PC board. It is called Voyager MkII.

This board has a better layout than the old taped-artwork board and everything is marked on the topside to help you with assembly.

The other difference is the board sits upright on the top of a 9v battery with the battery snap fitted to the side of the board via short lengths of tinned copper wire as shown in the photos.

This makes the battery snap very strong and it is easier to connect the board to the battery and take it off without damaging the track-work.

The other major difference is the addition of an air trimmer so you can adjust the frequency slightly after the project has been heatshrunk and keep the transmission away from other radio stations.

When we first started to produce these FM transmitters the FM band had only a few radio stations and it was easy to get a free spot on the dial.

But in the past few years the band has filled up considerably and it is now almost impossible to get an empty area where you can experiment.

That's why we have had to include the air trimmer. After the project is complete and heatshrunk, (you need to supply your own length of heatshrink tubing) final tuning can be carried out by cutting

an opening in the heatshrink for the trimmer so it can be adjusted with a small non-metallic screwdriver.

I should also mention two slight modifications have been made to the circuit. One is the change in value of the base bias transistor for the oscillator. It

SUMMARY OF SPECIFICATIONS

Range: 800 metres

Supply: 9v

Current consumption: 7mA

Battery life: 50 hours for ZnC

100 hours for alkaline

Tuning range: 80 - 110MHz (by stretching or compressing the oscillator coil)

Fine tune by adjusting the air trimmer (2MHz adjustment)

Stability: Bug to be left in situ - not to be moved or handled.

Antenna length - 170cm

has been changed from 220k to 47k as we found the 220k produced a small amount of distortion or hollowness to the audio, giving the impression the sound was coming through a pipe.

The other change is the positioning of the microphone. It is now mounted on the side of the board to make it easier to heatshrink.

These modifications are a result of us

PARTS LIST

- 1 - 470R surface mount (471)
- 1 - 10k " " (103)
- 1 - 47k " " (473)
- 1 - 68k " " (683)
- 1 - 1M " " (105)

- 1 - 10p ceramic
- 1 - 39p ceramic
- 1 - 1n ceramic
- 2 - 22n ceramics
- 1 - 100n monoblock (monolithic)
- 1 - Air trimmer 2p - 10p

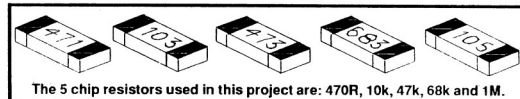
- 2 - BC 547 transistors
- 1 - 5 turn coil .5mm enamelled wire
- 1 - electret mic insert - high sensitivity
- 1 - 9v battery snap
- 1 - 9v battery
- 1 - 15cm tinned copper wire
- 1 - 30cm fine solder
- 1 - 170cm antenna wire

1 - VOYAGER - MkII PC BOARD

making hundreds of Voyagers for customers and the new layout is really a dream to put together.

If you have not built any of these FM transmitters, this is one you should not miss out on.

Refer to the full article in the book called "14 FM BUGS TO BUILD" before sending for the kit as none of the kits come with instructions. You are expected to have already seen the article and be familiar with the complexity before ordering.



The 5 chip resistors used in this project are: 470R, 10k, 47k, 68k and 1M.

ASSEMBLY

Before you do anything, prepare the workbench.

Lay out a couple of sheets of clean white paper and place the kit of parts on one. Don't take the resistors out of the carriers until you are ready - a resistor dropped may be a resistor lost.

Study the board and note all the components are identified by the printing on the top of the board, called the overlay or legend. You really don't need any instructions at all, but since this may be your first attempt at surface-mount, we will give you some helpful advice.

Note how the board stands on top of a 9v battery, with the battery snap soldered to the edge of the board. The positive and negative lands on the board are large to make the connections to the snap nice and strong.

The microphone fits on the top of the board via two short wires and overhangs the board. Some microphones come with wires attached and this makes them easy to fit. Other microphones may need to have wires attached and these can be obtained from the ends of capacitors. Use only very fine wire for this.

Only 4 components have to be fitted around a special way. These are the two transistors, the microphone and battery snap. All the other parts, including the capacitors, air trimmer, coil and resistors can be soldered around either way.

Once you have studied the photos, the PC board and components, you can start.

Here is the order for assembly:

- 5 surface mount resistors.
- 6 capacitors.
- 2 transistors.
- air trimmer
- 5-turn coil
- battery snap
- microphone.
- antenna lead.

Now for the finer points:

The surface mount resistors required a fair degree of skill and you have to be good at soldering if you want to make the board look neat.

Refer to the two diagrams on the following page and note the top diagram shows where each of the resistors goes according to the values shown on the circuit

diagram. The lower diagram shows the values of the resistors according to the 3-digit resistor code.

Place the strip of resistors on the workbench and take one out of the carrier strip, keeping the code numbers on top. Turn the resistor around so that the numbers make sense (make sure you don't read the numbers around the wrong way!) and place it on the board as shown in the photo and diagram, so that it is correctly placed on the solder lands.

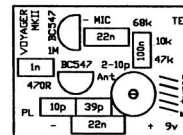
There are two ways of soldering the chip. One is to sit it in place and heat one end with a soldering iron while applying solder and then repeat with the other end.

The other is called RE-FLOW.

In this method, you add a little solder to each land and tin each end of the resistor while holding it in your fingers. Yes! You can actually hold the chip while soldering the opposite end. If you can't, you are taking too long.

When both the lands and the ends of the chip are tinned, it is placed in position and held with a piece of wire such as a paper clip while one end is touched with a soldering iron. This is repeated with the other end.

It is important not to put any force on the



Actual size artwork showing the size of the board and the top overlay.

chip as the ends can be easily fractured and the resistor will go open circuit. A hairline crack will be produced that you will not be able to see. The only way to check that the resistor has not been damaged is to measure it with a multimeter.

The other 4 chips are placed on the board in exactly the same way, making sure they are covering the lands and sitting flat on the board.

Double check the codes and if everything is correct you have carried out your first surface-mount construction!

The rest of the assembly is a lot easier, it's just a matter of doing things in the correct order.

All the other components are mounted on the top of the board and when two formats are combined like this, the assembly is called HYBRID.

Refer to the layout diagram for the placement of the 6 capacitors. These are soldered in place, one at a time. Some of the leads may have to be bent slightly to allow the component to fit down the holes as it is almost impossible to get all components in either .1" or .2" spacing.

Next, the two transistors are soldered in place. Push them down as far as they will go as we want to keep the profile low. In addition, we have designed the circuit with the transistor leads as short as possible. If you place the transistors high off the board, the performance



of the oscillator will be different to our prototype.

Solder the leads quickly so that you don't heat up the transistor too much.

The air trimmer is next. This must be soldered very quickly otherwise the plastic insulation between the plates will

specified, the circuit must be as tight as possible and this means the battery must be as close to the board as possible. To do this we take a battery snap out of its plastic jacket and solder it directly to the edge of the board. The "crown" terminal is soldered to the positive land on the board. Use plenty of solder at it is necessary to make a good mechanical connection.

The terminals must not be able to rotate and if they can be turned, they should be soldered at the centre of rotation. Use very little solder inside the crown as the positive terminal of the battery must be able to fit inside it to make contact. One of the last components to fit is the microphone as its two leads are very fine and any bending will cause them to break.

The microphone in the kit comes with two short wires attached and if you look at the solder-lands on the back you will see one goes to the case. This is the negative terminal and must be soldered down the negative hole on the board.

Finally the antenna. This is soldered down the hole marked "ant."

melt. Keep a finger on the trimmer to act as a heatsink and everything will be ok.

The coil is made from enamel coated wire and this coating must be scraped off with a knife or burnt off with a hot soldering iron so that the two ends are bright and shiny and TINNED before fitting to the board.

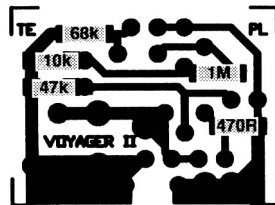
The kit comes with a pre-wound coil but if you are making it yourself, here are the details:

Wind 5 turns of 24B&S (.5mm) or 21B&S (.71mm) on a 3mm diameter shaft such as a medium Philips screw driver and space the turns as shown in the photo.

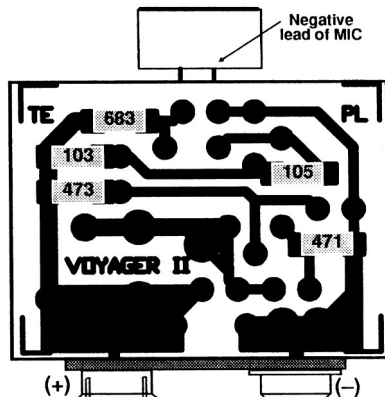
The coil determines the frequency of the oscillator and the turns will be stretched apart or squashed together after the project is complete. At this stage it does not matter about the spacing of the turns, as long as the ends fit neatly down the holes in the board.

If you have made the coil from enamelled wire, don't forget to tin the ends. This is done while the coil is on the screwdriver so that it acts as a heatsink. Push the coil up to the board and solder it in place with the turns evenly spaced.

Now the battery snap. If you want this project to get the range we have



The resistor values as compared to the circuit diagram.



Twist two pieces of tinned copper wire together and use it to solder the positive and negative terminals of the 9v battery snap to the PC board.

You have a choice of two antennas, a 15cm tinned copper wire antenna and a 170cm half-wave antenna. This has been done to allow you to experiment as the main purpose of these FM transmitters is to achieve the greatest range with

the least power. We want you to try different antenna combinations to see which is the most effective.

If you only want about 30-50metre range, the 15cm antenna will be sufficient but if you want to get the maximum range, you will need the half-wave antenna.

SETTING UP

Once all the components have been soldered in position, the project can be set up and tested for performance. The test procedure is to connect the LED Power Meter to the antenna point on the board.

The construction and use of the LED Power Meter is covered in the Amoeba article and you can find it in the book "14 FM BUGS TO BUILD."

It is designed to take the RF output and turn it into a DC voltage so that you can read it on a multimeter.

By using this piece of test equipment you can determine if the project is delivering an output, however you do not know if the frequency is on the FM band or outside it - this will be the next test. But firstly you should see if the output is

between 6v and 12v, for a 9v supply. The variation in voltage will depend on the quality of the oscillator transistor, the frequency being produced and the "lightness" of the circuit.

The next step is to see if the output is on the FM band and to do this you can leave the LED Power Meter connected to the output as its short lead will act as an antenna.

Bring an FM radio near the project and turn the volume up full so that when you tune across the band, you will hear a squeal when the frequency is detected.

By moving the Voyager away you will be able to pick up the sounds it detects. Make sure the frequency of transmission is well away from any radio stations as the signal from a station will swamp the Voyager when you are testing it for range. You can do this by adjusting the air trimmer. You can see the vanes moving in and out of mesh with the stators and the meshing should be midway at the start so that you can raise or lower the frequency by turning the trimmer.

As the vanes move out of mesh, the capacitance of the trimmer decreases and the frequency of the bug increases. When adjusting the capacitor you must

use a non-metallic instrument. The best is a plastic knitting needle filed to make it into a flat screwdriver.

If you do not get a squeal from the radio you can assume the frequency is lower than the band (as we have designed the output to be very close to the bottom of the band) and it may be just a little too low.

In this case you will have to raise the frequency by expanding the turns of the coil. This will bring the output onto the FM band and you can shift it slightly up or down with the air trimmer to get it away from other stations.

You can now solder the short antenna onto the board if you require a range of about 30-50 metres or use the half-wave antenna if you want 800 metres.

To get the maximum range, the antenna should be stretched out straight and placed either horizontally or vertically. The receiving antenna must be in the same plane to get the maximum range and both antennas should be as high as possible.

The signal is generally not affected by brick walls, glass or plaster but it will not pass through metal of any kind such as the foil insulation as currently required in the walls of new buildings.

The signal will also find it difficult to get out of a car and you must place the antenna near a window but not close to the metal frame-work as this will almost totally absorb the signal. The range from a car will be limited to about 100 metres so don't expect any more.

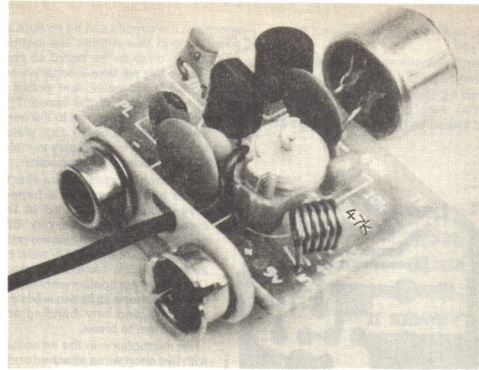
In the open, you should be able to get a lot further than 800 metres as our test was made from our assembly room and over a slight hill so we can give you a genuine range as might be expected in a normal situation.

IF IT DOESN'T WORK

If you cannot detect an output on the LED Power Meter, you can safely assume the oscillator stage is not working.

Measure the current for the project. It should be about 7mA. If it is only about 3mA, the oscillator transistor may be damaged or not being turned on. The only voltage you can measure with an ordinary multimeter is the emitter (2V), as the base requires a very high impedance meter to get an accurate reading. If the emitter is zero, the transistor is not being turned on and you should check the 47k base-bias resistor. If it is about 3V, the 10p feedback capacitor may be open. If it is 9V, the transistor may be shorted or the 470R resistor may be open circuit.

But the most likely cause will be a soldering fault, such as a bridge between two tracks, poorly soldered joints, or two components that have been swapped - such as the 47k and 470R.



The best thing to do is give the project to someone else to check as it is very difficult to check your own work.

If you have used your own parts to build the project, the fault could be in the markings on the components (or incorrect reading of the values) or the wrong size coil. The only solution is to buy a kit and put it together - you can then compare one project against the other.

If you are picking up a blank spot on the dial but no audio, the fault will lie in the first stage or the microphone.

Check the voltage on the collector of the audio transistor. It should be about 2V, however if it is above 6V or less than 1V, the transistor will not be biased correctly and the 1M base-bias resistor may be at fault.

The electret microphone needs only about 50mV across it to work correctly and the only real way to check it and the audio stage is to use a CRO or audio amplifier (our prototype had 200mV across the microphone). By whistling into the microphone at a distance of about 30cm you will get an output of about 10mV - 30mV. The audio transistor will provide a gain of about 70 and produce an output of about 700mV - 2,100mV.

If the microphone does not produce at least 10mV, it may be around the wrong way, damaged, or have very low sensitivity. Reducing the 68k load resistor may help if the microphone is a low sensitivity type.

FITTING THE BATTERY

The Voyager is designed to fit on top of a 9V battery and doesn't need any case or potting. The safest thing is not to enclose it at all.

Fully-assembled devices are available from Talking Electronics for those who

are not good at soldering or want a built-up unit. They are covered with heatshrink so they can be safely handled and easily fitted to a battery. You can heatshrink your model by buying a short length of tubing and placing it over the board and shrinking with a candle or gas torch. Crimp the ends with a pair of pointed-nose pliers to make them stick together. Cut around the two battery terminals and make a smaller hole for the

SURFACE MOUNT PACKS CHIP RESISTORS

¹/₁₆WATT
2 off each value 10 ohms to 1M
(60 resistors)

\$12.00 plus \$1.50 post

CHIP CAPACITORS

2 off: 10p to 100n, 10u, 47u
(60 capacitors)

\$18.00 plus \$1.50 post

Send to:
TALKING ELECTRONICS
35 Rosewarne Ave.
Cheltenham, Vic. 3192

air trimmer so the frequency can be adjusted, and the project is ready for use.

That's about it. If you like the challenge of working with surface-mount components, we have produced a more advanced FM transmitter, called the VOX V, using almost total surface-mount technology. This project is described in the next article. It can be purchased for \$32.50 plus post. But only get it if you are really confident.

BUGGING HYPE

It may surprise you to know that many articles in magazines are quite flawed. Unless you know the particular subject-matter intimately, it is difficult to detect the mistakes but one area we know very well is security and when we read some of the things other writers say, we get quite a shock.

A short time ago a journalist telephoned us wanting to know some of the details of the devices we produce and a few comments on the industry in general.

I talked to him at some length and also had another discussion at a later date, after he had spoken to other contacts.

Towards the end of the discussion I suggested he send me a copy of the text before it went to press to make sure the subject-matter was technically correct.

He flatly refused, citing his professional capability of being able to digest material and construct an accurate article around it.

His results appeared in a magazine last week and just as I had suspected, the technical facts were far from accurate. In fact they gave me a laugh.

I am not suggesting the faults are those of the author, he may have been given false information from his sources. However, the resultant article was filled with technical mistakes.

To save being sued for my critical analysis of the article, I have changed the details and incorporated items from other articles so that nothing can be related to any particular article.

You will understand the absolute necessity to do this as any form of criticism invites enormous law suits in Australia. You can go bankrupt by merely inferring someone is incompetent - we have already been threatened 6 times!

The first inaccuracy I would like to expose is the description of one of the most amazing bugs to be invented. Believe me, if it were remotely possible, the inventor would be a multi-millionaire. Every army and security agency in the world would beat a path to the inventors door.

It's a bug in a power point called a "burst bug." It collects 30 seconds of information and sends it down the 240v mains in very short bursts - one nanosecond - one millionth of a second.

To start with, one nanosecond is not one millionth of a second. It's one thousandth of one millionth of a second.

In other words the bug is operating at 1,000MHz. You can't get 1GHz down the power lines! So how can you get 30 seconds of audio into 1,000MHz? You simply can't.

Next he says the most popular method of defeating a bug in a room is the "white noise generator." A white noise generator is similar to a radio turned up loud when it is off the station.

Anyone with the most basic understanding of audio will realise that if you can conduct a meeting with a noisy radio in the background, a tape-recording of the meeting will be equally easy to understand.

Obviously the author has never used or seen any of the equipment he is describing and he falls into a big hole when he makes statements like this.

He also says a radio transmitter operating from the voltage of the phone line will transmit 400 metres. We would not, in our wildest dreams, ever specify 400 metres for this device. You may get 100 metres if you are lucky as the phone line is not an ideal radiator of RF energy and you cannot leech enough energy from the line to produce a guaranteed 400 metres. You may get 400 metres from the top of a hill to the valley below, but how many people live on a hill?

We only specify ranges that are obtainable under most situations, so that the purchaser of any of our devices is not disappointed with the results he gets. This is not the case with overseas products. It seems they give things almost any range they can dream up. We have tested bugs with a supposed range of 400 metres and only managed to get 50 metres!

The author of another article states that some customers have paid \$100,000 to plant a bug under a rival's board-room table. This is absolutely absurd. You can get a cleaner to leave something behind for \$100. You can put a bug in a box and turn it on remotely so that it will never be discovered. A bug like this costs less than \$500 - so why spend \$100,000?

When you know the reality of the situation, it makes scary articles like this just a load of hype.

There is, however, another bug mentioned in the article that will be available from us in the near future.

It's a voice activated tape recorder, a bit like an answering machine, that picks up conversations in an office or other enclosed area. It is also connected to the phone line so that when you dial the number via a secret code, it answers the phone. You can rewind the tape remotely via a set of tones and listen to the tape - then reset it for the next day's recording.

For every device that is represented correctly in these type of articles, there

is one that is over-rated.

Take for instance the parabolic microphone or parabolic dish. It is stated that one supplier is offering a unit that will detect conversations up to 150 metres away.

Yes, I agree, you can hear people talking with the naked ear up to 150 metres away on a cool, calm day such as at the beach, when the air is calm and there's no surrounding noises to distract you. But no parabolic dish has ever offered any better than a 10dB gain and this is almost worthless on the audio scale. Cupping your hands behind your ears gets a 10dB improvement. So why pay hundreds of dollars to save cupping your ears?

Instead of a dish bug, it's best to have someone take a transmitter up to the party in question and leave it behind. You can then tune a radio to the bug and hear the conversation.

Many hype articles also talk about equipment costing \$1,000 or more: such as brief case bugs, long-range transmitters, car trackers etc. We have access to some of these high priced devices and even though we have been in business for more than 10 years, we have only been asked for them on very few occasions. But when it comes to seeing the customers money, we have never sold a single device.

Another article states an estimated \$50 million a year is spent on surveillance and counter-surveillance.

This figure could be plucked from anywhere. The article does not state where the information comes from or what specific items it relates to. It could include security and surveillance cameras at shopping centres or traffic control or even the video cameras required by investigators for insurance fraud etc. It certainly doesn't relate to room and phone monitoring devices or even bug detectors as the number of devices sold in this category is absolutely minuscule.

Last of all I laughed at this little inclusion: A writer states that many of the bugs are assembled by high school students. I don't know what he is trying to allude to but if you want to go the full hog, I can state that many of the overseas bugs are made by Chinese and Japanese children as young as 8 years of age and they haven't a clue about electronics at all!

It's amazing how many inferences and discrepancies are put into a story - especially a story on bugs and security devices. This is the sort of thing a journalist does when he is totally out of his depth.

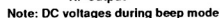
Maybe you can send us other articles so we can pull them apart and expose them, and you can see what other rubbish you are being fed.

TE

VOX = Voice Operated Switch

LED power meter required to peak the bug: \$1.10

PCB layout by Justin Vietz



Q 1T for top board - small board

In addition, we have included a side view to show how the two boards are fitted together.

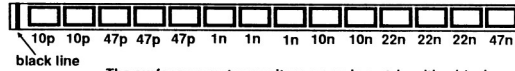
The first component to fit is the IC. Pin 1 for the chip has been marked on the enlarged diagram and this corresponds to the slight depression at one end of the chip. Make sure the pins line-up before soldering the diagonally opposite pin. Then solder the rest of the pins, quickly and cleanly without overheating the chip. Solder a few pins then wait a while to let the chip cool down.

Next fit the resistors. They are clearly marked with numbers and to help you with the values we have provided a list:

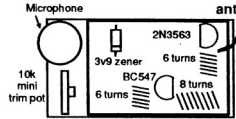
SURFACE MOUNT RESISTOR VALUES:

470R marked as 471 on chip
4k7 marked as 472 on chip
10k marked as 103 on chip
22k marked as 223 on chip
39k marked as 393 on chip
47k marked as 473 on chip
470k marked as 474 on chip
1M marked as 105 on chip
2M2 marked as 225 on chip

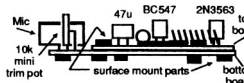
The peaking of the bug is carried out exactly the same as the VOX MkIV and will not be repeated here. Refer to the



The surface-mount capacitors come in a strip with a black line at one end as shown in the diagram above.



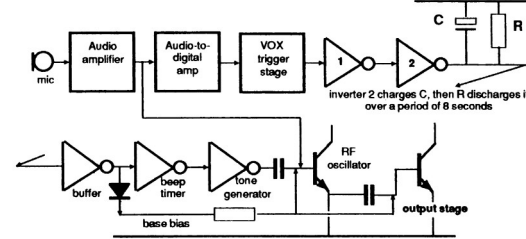
The two boards fit together like this, with the surface mount parts as shown:



Remember: ALL the components for the small board fit on the track-side. All the components for the large board fit on the track-side, except the microphone and 10k mini trim pot.

PARTS LIST

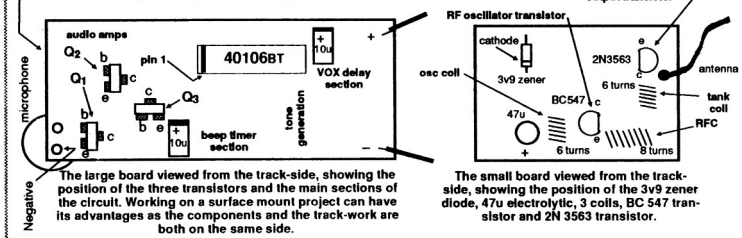
- 1 - 470R ALL surface-mount
- 1 - 4k7 1 - 47k
- 4 - 10k 1 - 470k
- 2 - 22k 4 - 1M
- 1 - 39k 1 - 2M2
- 1 - 10k mini trim pot
- 2 - 10p ceramics surface-mount
- 3 - 47p ceramics " "
- 3 - 1n ceramics " "
- 2 - 10n ceramics " "
- 3 - 22n ceramics " "
- 1 - 47n ceramic " "
- 2 - 10u 16v tantalums " "
- 1 - 47u 16v electrolytic PC mount
- 3 - BC 848 surface-mount transistors
- Marked as "1k"
- 1 - BC 547 transistor
- 1 - 2N 3563 transistor
- 8 - BAS16 surface-mount diodes
- Marked as "A6s"
- 1 - 3v9 zener diode 400mW
- 1 - HEF 40106BT surface-mount hex Schmitt trigger IC
- 1 - electret microphone insert
- 2 - 6turn .5mm wire 3mm dia enamel
- 1 - 8turn .5mm wire 3mm dia enamel
- 1 - spdt mini slide switch
- 1 - 15cm tinned copper wire for feedthroughs
- 1 - 50cm fine solder
- 4 - 'N' cells
- 1 - 175cm antenna wire
- 2 - VOX MkV PC boards (one large, one small)
- 1 - LED Power meter kit (for peaking) available for \$1.10 extra.



BLOCK DIAGRAM OF VOX MkV

10k mini pot under

Some of the major components to help with fault-finding:



VOXIV article in Learning Electronics book 2 for fault finding and other related information.

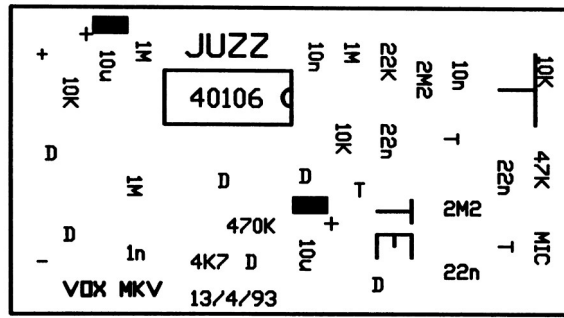
PARTS IDENTIFICATION

The only area we will talk about is the

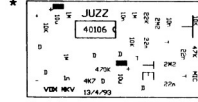
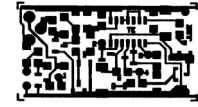
identification of the surface-mount components.

The transistors and diodes look similar as they are in the same type of package. But there are only three transistors and

8 diodes. You will find the letters "1K" or similar letters on the transistor package while the letters "A6" appear on the diode case. These letters may vary from one batch of components to another so

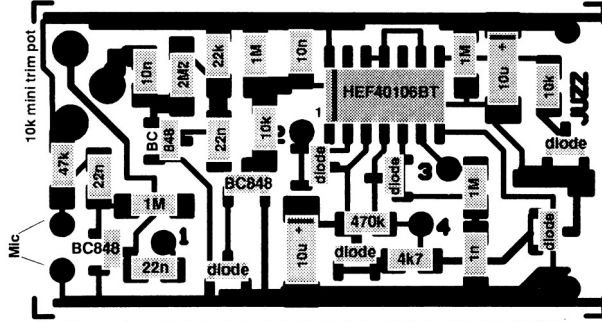


The diagram above shows the overlay of the large board for the VOX MkV. All the components solder to the track-side except the microphone and 10k mini trim pot.

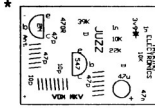


Full size artwork for checking your boards.
It is not worthwhile making your own boards as you must buy the surface-mount components as a kit - they are not available separately.

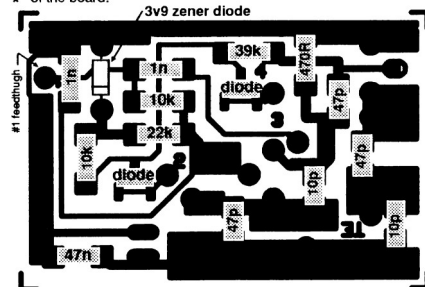
* Indicates matching corners



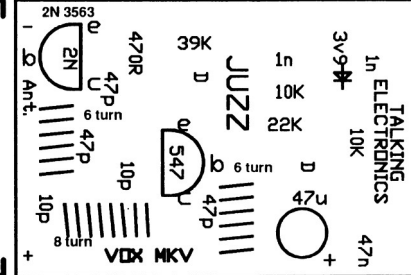
The diagram above shows the placement of the surface-mount components on the large PC board for the VOX MkV. The microphone and 10k mini trim pot are placed on the top of the board.

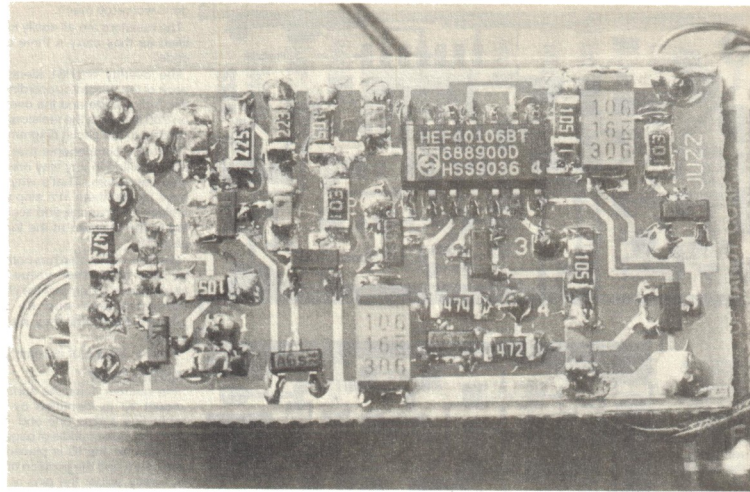


Refer to the diagram at the top of page 59 to see how the two boards fit together after the components have been soldered in place.



The diagram above shows the placement of the surface mount components on the small PC board. The 3v9 zener diode, 470u, the three coils and the two transistors: BC 547 and 2N 3563 mount on the track-side of the PC board.





A hole is then cut in the heatshrink for the microphone and sensitivity pot. To prevent the heatshrink from damaging the two coils near the edge of the board, a small piece of PC board or plastic should be fitted beside the edge of the board so that the coils are not squashed as the heatshrink contracts during shrinking.

Fit the four 'N' cells and the project is ready to go into operation. Don't forget to add the mini slide switch to the end of the cells so that the project can be turned off when not required.

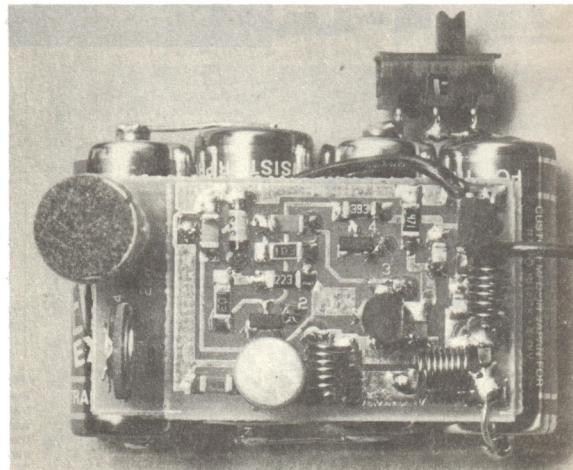
Only you will know and appreciate the work and skill that went into putting it all together. Try it out and see how fantastic it performs.

These large photos show you exactly where the parts are fitted to the board. Don't forget, the photos are 2½ times larger than actual size so don't think the project will be a breeze.

The most difficult component to solder in place will be the electrolytic as you have to get under it with the iron to solder the short leads.

You can also see how the feed-throughs are soldered from one board to the other.

This photo clearly shows the identification on the transistors (1k in our case) as compared to the diodes (A6S in our case). These numbers may be different in your kit so make sure you know which is which before starting. The IC has a chamfer along the bottom edge of the chip. This gives pin 1 identification at the left hand end of the chip.



SECURITY AND SURVEILLANCE DEVICES

TALKING ELECTRONICS

35 Rosewarne Ave., Cheltenham, Vic. 3192 Tel: (03) 584 2386

NOTE: All devices must be installed and monitored correctly and only used on your own personal phone and phone line. You must not invade others' personal rights and privacy. Bugs must not be altered in any way or "boosted." All circuits and designs are copyright and must not be duplicated in any way.

These devices are intended for use in home, office, farm and outdoor use where the signal will not interfere with any radio stations on the FM band.

All phone tape devices comply with Austel specification 5.9.3.4(c) and cannot intercept a communication over the telecommunication system.

No devices have been approved by Austel and the conditions on the following page apply. Read them carefully. Austel approval for any device will cost between \$3,000 - \$15,000. When you get any device approved, please let us know so that we can put the approval number on the item.

Extra information sheets are available as follows when you purchase these products:
Fitting the Spider SP-01 & diagrams, Fitting the Scorpion SC-01 & diags, Fitting the Scorpion SC-03 & diags, Fitting the Phone Tapes & diags. Timing for Infinity Bugs.

BATTERY CHANGES etc:

2 batteries - \$7
4 batteries - \$9
8 batteries - \$12
Return postage - \$5
Minor repairs - \$15
Major repairs to be quoted
Customised work \$35 per hour

HIRING

Most devices can be hired on a daily basis.
Ring for further particulars.

Deposit on any device is the cost of the device.

Hiring charge: 25% of cost of device per day with reductions for longer periods.

TELECOMMUNICATIONS ACT 1991

SECTION 255

Sale of customer equipment for which there is no permit.

255. A person must not sell or supply, or offer to sell or supply, to another person customer equipment that the person knows, or ought reasonably to know, is customer equipment the connection of which to a telecommunications network would be contrary to subsection 253 (1), without first notifying the other person, as prescribed by the regulations:

(a) that there is no permit in force for connection of the equipment to a telecommunications network; and

(b) if the regulations so provide - about the consequences of connecting the equipment to such a network without a permit. Penalty: \$12,000.

REGULATIONS

3 New regulations 7 and 8 and Schedule

3. 1 Add at the end:

Sale of customer equipment for which there is no permit

7. (1) A notice to be given under section 255 of the Act by a person selling or supplying, or offering to sell or supply, customer equipment that the person knows, or ought reasonably to know, is customer equipment the connection of which to a telecommunications network would be contrary to subsection 253 (1) of the Act must be in writing and must state:

(a) that there is no permit issued by AUSTEL in force for connection of the customer equipment to a telecommunications network; and

(b) that, if the equipment is connected to a telecommunications network, the equipment may become dangerous or may damage the network; and

(c) the penalty for knowingly or recklessly connecting the customer equipment to a telecommunications network.

[NOTE: The notice should be substantially in the following form:

This customer equipment has no AUSTEL permit and may be dangerous or damage a telecommunications network. Connection to a telecommunications network is an offence under section 253 of the Telecommunications Act 1991 and may attract a maximum fine of \$12,000.]

(2) A notice under subregulation (1) must be:

(a) in not less than 10 point typeface; and

(b) conspicuously, permanently and legibly cast or etched into or fixed by means of a plate or label to the customer equipment and

(c) conspicuously, permanently and legibly etched into, printed on or fixed by means of a plate or label to any packaging in which the goods are offered for sale or supply.

(3) A plate or label referred to in paragraph (2) (c) must not be capable of being removed from the packaging to which it is fixed without defacing the Packaging.

Please note that while all the devices designed and produced by Talking Electronics are constantly going through stages of refinement and improvement, and that some of the devices are being prepared for submission for approval, at the time of preparing this catalogue, NONE of the devices have been finally approved and thus the above conditions and descriptions apply to all devices being offered.

It is understood that this catalogue or a similar set of pages has been read by all purchasers of Talking Electronics security equipment and that the situation is understood fully.

It is also understood that this page takes the place of any plate or label required to be affixed to any such products or packaging as the products and/or packaging supplied by Talking Electronics do not lend themselves to such affixtures.

SECURITY DEVICES

The following is a complete list of security devices from Talking Electronics. All items are professional quality and guaranteed to perform as described. If you are not certain about your requirements, please phone for advice.

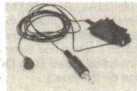
Don't let the low prices put you off. All devices are as good as or better than anything else on the market as they have been designed and made by us. There is no import duty or high mark-up. We make what we sell.

We have also developed a range of Smart Alarms for home, factory and office that silently dial up to 3 numbers as soon as an intrusion is detected.

These alarms are about half the cost of anything similar on the market and have many exclusive features. Ring for further details. Our phone number is : (03) 584 2386.

Here is our product range:

ACTIVE MICROPHONE \$45 (plus \$5.00 post). This device can be used with any tape recorder to improve the sound pick-up. Most micro-cassette recorders are useless when left in your pocket or in a room. They don't pick up voices very well at all. This active microphone turns them into superb performers.



ANSWERING MACHINE STOPPER \$30.00 (plus \$5.00 post). This device connects to your answering machine and will automatically disconnect it whenever any phone is picked up. It allows your answering machine to be permanently connected to the line.



BRIEF CASE BUG BC-01 \$150 (plus \$10.00 post). This is a quality brief case (combination lock type) fitted with a super-sensitive bug, capable of transmitting about 100 metres. The case can be 'left behind' and the conversation picked up in a nearby room or car.



BUG DETECTOR 2000 BD-2000 \$150 (plus \$5.00 post). Detects transmitting bugs in a room, car, office or telephone. The unit works on the wide-band principle of RF detection. It is switched on & the antenna extended. With a sweeping motion the antenna is probed into all parts of the room. The unit will give a feedback whistle when a bug is detected. The volume control is turned down and a meter on the detector indicates the relative strength of the bug. In this way you can 'home in' on the exact location of any transmitting device. For phone use: Wind the telephone cord about 4 times around the antenna and place the mouthpiece of the phone to the speaker of the detector. A feedback whistle will indicate any RF bug that is on the line within 20 metres. Be sure to test every phone as some bugs are designed to operate on one specific extension only.



CAR TRACKING TRANSMITTER CT-02 \$65 (plus \$5.00 post). This unit fits to the underside of a car with double sided foam tape and transmits a beep up to 400 metres. Use a directional antenna or standard FM radio to pick up the signal. The unit has very low battery consumption and will last up to three months of continual use.

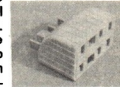
CAR TRACKING TRANSMITTER CT-03 \$95 (plus \$5.00 post). Same as above but with centrifugal switches to indicate when the car is turning left, right or stopping. Comes with very strong magnets so you can clamp it to any metal object. Standard model with double-sided stick tape: \$85.00



DETUNED FM TRANSMITTERS AND

RADIOS Most of the FM Bugs and radios we sell can be detuned so that you can get your own private channel just below the broadcast band. Ring for cost and availability before ordering.

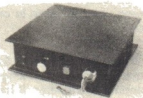
DOUBLE ADAPTOR BUG DA-01 \$140 (plus \$5.00 post). This is a transmitting bug, fitted into a double adaptor. It is very easy to install and can be fitted in less than 30 seconds. Remove the phone plug from the wall, fit the double adaptor and then refit the phone into the top of the adaptor. The bug transmits on the phone line when the phone is in operation and the range depends on the effectiveness of the line as an antenna. 100 metres is about maximum.



ELECTRONIC STETHOSCOPE \$120 (plus \$5.00 post). This unit has been designed for locksmiths who are constantly required to open combination-lock safes after the owner has forgotten the combination. It has a magnetic transducer that attaches to the safe so that you can hear the slightest click of the mechanism. It also has a number of other uses such as detecting noises in engines, the rushing of water in leaky pipes and you can even hear your heart-beat.



HOME GUARD \$295.00 (plus \$10.00 post). Home Guard monitors the air pressure in a home, office or flat and detects when any outside door is opened. It is a self-contained unit with internal batteries that will last up to 48 hours of monitoring. It comes with a plug-pack for recharging the batteries or for continual monitoring. It is ideal for placing beside a bed or desk to detect any entry into the premises. The sensor covers an area up to 20 squares and as soon as a door is opened, the inbuilt siren is activated. It has a soft-start so that you can turn the alarm off via a key switch before the ear-piercing 110dB sound is emitted. Home Guard is an entirely new concept to security and its effectiveness has to be seen to be believed. Ideal for the elderly or anyone in a large or small flat. The advantage of this system is it can be left on while walking around as it is not triggered by movement or pets.



INFINITY BUG (SIMPLE TYPE) IBR-00 \$150 (plus \$5.00 post). This is the simplest version of our popular infinity bug. It is small enough to be placed in the base of the phone and works like this: After making a call the other party hangs up. Instead of hanging up, you whistle down the line and the bug will 'open up'. You will then be able to hear everything that is being said at the other end. Note: This model requires someone at the



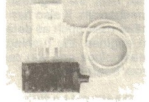
other end (or a FAX machine) to answer the phone, every time you wish to use the bug. Size: 2cm x 3cm x 6cm. Also, all infinity devices must be connected to the line in the room you wish to listen to. You cannot place it on your own phone then dial someone else. The bug **MUST** be at the other end.

INFINITY BUG RING VERSION IBR-01 \$250 (plus \$5.00 pack and post). This unit is connected to the phone line and has a super-sensitive microphone and a complex circuit to detect a coded phone ring. It can be installed in a home, office or factory and is ideal for checking on the presence of staff or burglars etc.

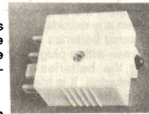
It works like this: The unit is connected to the number to be monitored as per the instruction sheet accompanying it and a special note is made of the time intervals required to activate the device. When you ring the monitored number you must let the phone ring for only one or two rings. At the receiving end, this will sound like the beginning of two rings. You then hang up and wait an exact number of seconds (as supplied on the instruction sheet), before calling the bug again. This time, when the phone starts to ring, the bug switches on and the bell does not sound at all. Again you wait until you hear a click on the line. When you hear the click, whistle down the line and this will open up the bug and let you hear whatever is happening in the room being monitored. The sounds are clearer than if you were in the room and if someone picks up the phone, the bug automatically hangs up. The bug times-out after 5 minutes and can be immediately re-activated by whistling to keep the line open. You can hang up at any time. The bug works on both decadic and DTMF (rotary dial and tone phone systems). The bug also works in another mode. After making a normal phone call to the bug, the person at the other end will hang up. But you don't hang up. Instead whistle down the line and this will open up the bug and you will be able to hear what goes on after the call has terminated.



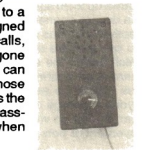
INFINITY BUG NO RING VERSION IBNR-01 \$350 (plus \$5.00 pack and post). Same operation as the ring version, except that while you are accessing the bug, the phone does not ring at all. You can access the bug without anyone at the other end knowing. This unit cancels the ring on both mechanical and electronic phones.



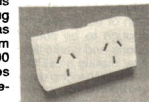
LINE GRABBER \$35.00 (plus \$5.00 pack and post). This device prevents any other phones in the house being used to listen in on a conversation.



LISTENER LI-01 \$75 (plus \$5.00 pack and post). The listener is similar to a telephone amplifier. It has been designed to listen to the line when making FAX calls, to let you know when the fax has gone through. It will defeat infinity bugs and can be used as an amplifying device for those who are hard of hearing. It also monitors the extension phone to prevent the embarrassment of picking up the main phone when the extension is busy.



MAINS BUG MB-01 \$140 (plus \$5.00 pack and post). A 240v mains bug in a modern-type double adaptor. Has good sensitivity and can listen to room conversations. Range: about 50 - 100 metres. The main advantage is it derives its power from the 240v mains and therefore does not require battery changes.



MICROCASSETTE RECORDER \$120 (plus \$5.00 pack and post). This is the size of a few boxes of matches and takes a MC-90 (90 minute micro-cassette). Active Microphone can be fitted to improve its ability to pick up quiet conversations in a room.



MINISTERS

MICROPHONE \$65.00 (plus \$5.00 pack and post). This is a wireless microphone that can be placed on a person so that he or she can move around such as required by a minister, teacher, auctioneer, etc.

PHONE BUG SNIFFER PBS-01 \$150 (plus \$5.00 pack and post). The Phone Bug Sniffer will detect 3 different types of 'taps' on the line including 'EXTENSION PHONE', 'INFINITY BUG', and 'SERIES BUG'. The unit requires INTERNAL ADJUSTMENT before it will operate on a given phone line. It will not detect bugs that are already installed. It only detects if a bug has been added after the unit is installed. (See Bug Detector 2000 for RF bugs on the line.)

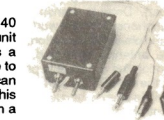


PHONE TAPE PT-01 \$120 (plus \$5.00 pack and post). Comes with 2 alligator clips to be connected to the phone lines (called parallel connection) so that when the handset is picked up, the tape starts. The 2.5mm plug fits into the remote socket and 3.5mm into the MIC socket. The circuit is powered by four AA cells and this will last many months as power is only consumed when the device is operating. For the Phone Tape to work, the recorder must have jacks labelled 'REM' and 'MIC'.



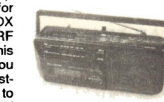
PHONE TAPE PT-01T \$130 (plus \$5.00 pack and post). Identical to PT-01 except the input lead has a Tee piece for connecting to the phone line. The phone is plugged into the other end of the Tee piece. This unit is easy to install in a matter of moments.

PHONE TAPE PT-05 \$140 (plus \$5.00 pack and post). This unit is similar to PT-01 except it has a timing circuit to limit recording time to the first 5 minutes of a call. (This can be switched off if not required.) This allows you to get up to 12 calls on a C-120 cassette.



PHONE TAPE PT-05T \$150 (plus \$5.00 pack and post). Same as PT-05 but with Tee piece for quick connection to the phone line.

RF OPERATED TAPE RECORDER RFT-01 \$180 (plus \$10.00 pack and post). This tape recorder is designed for use with the SCORPION or VOX bugs. It turns on when it picks up RF transmission. The advantage of this is it can be left unattended and you can catch every event without wasting hours of tape. It will record up to 1 hour of speech and can be placed

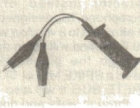


50 - 100 metres away, in a convenient location. Comes complete with C120 tape.

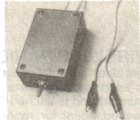
RF OPERATED TAPE RECORDER RFT-01S
\$220 (plus \$10.00 pack and post). This unit is the same as the RFT-01 except that it has a special slow-down feature to increase the recording time to over two hours per side of a C 120 tape.

SECURITY CAMERA \$250 (plus \$10.00 pack and post). This is a brilliant idea. It is a combination of a security lighting system with an automatic camera so that when the security lights come on, the camera takes a photo. The camera can be set to automatically take 1, 2 or 3 photos when the intruder is detected by the PIR on the security lights and the intruder will be basically unaware that he is having his photo taken. It is ideal for protecting driveways, houses, offices, safes, work-sheds, beach properties and almost anything of value. The camera can be mounted behind a picture or in a cavity wall so that the intruder is not aware of the operation. If you place a clock in the frame of the photo you will have hard evidence plus the time of the break in.

SCORPION SC-01 \$140 (plus \$5.00 pack and post). This bug is designed to transmit telephone conversations up to 100 metres. It uses the phone line for both power and antenna and there are no wires. The transmitting range will vary depending on your telephone line. If the line is above ground it will be better than if underground. The only way to find out is to buy one and try it. It can be returned for a SPIDER if required. It is fitted in series with one phone wire and comes with full instructions.

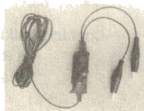


SCORPION SC-03 \$220 (plus \$5.00 pack and post). This bug is designed to transmit telephone conversations up to 2km. It is connected in PARALLEL with the phone line and will pick up all phones on the line. It has an internal battery that automatically recharges between calls and comes with a 1.7m antenna. Can be used with RFT-01 for automatically recording phone calls.



SMART EXTENSION BELL \$60.00 (plus \$5.00 pack and post). This is a very clever idea that fits to your phone line and produces a loud ring. It is ideal for noisy environments or large offices; even large back-yards or double storey houses. But the clever part is the bell starts off softly so that if you are near the phone, you will be able to answer it before the whole household is woken up. On the other hand, if you are not near, the bell will increase in loudness so that you can hear it over the noise of machinery or at the extremities of a large building etc.

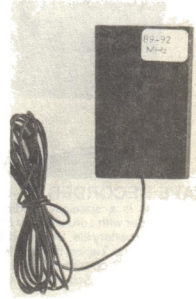
SPIDER SP-01 \$140 (plus \$5.00 pack and post). Identical to the SCORPION, except it has an antenna for better transmitting range if you have a poor phone line.



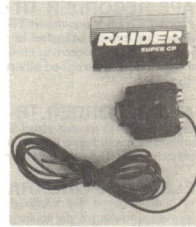
SPY BUG 100 SB-100 \$85 (plus \$5.00 pack and post). The bug is the size of two 20c coins. Comes with 60cm antenna and is capable of transmitting about 100 metres.



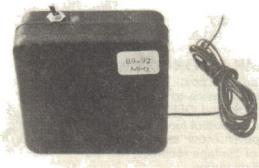
SPY BUG 400 SB-400 \$50 (plus \$5.00 pack and post). A super sensitive FM bug capable of transmitting 400 metres in a built up area and is fixed at a frequency about 88 - 90MHz. It can pick up sounds such as the ticking of clocks, whispers etc up to 3 metres from the microphone. It is the size of a Tic tac box and is powered by two AAA cells and will transmit for 200 hours. The batteries are soldered in place for reliability and the unit is returned to us for battery replacement (\$7.00) after 200 hours use.



SPY BUG 800 SB-800 \$55 (plus \$5.00 pack and post). A very small bug that fits on top of a 9v battery and transmits up to 800 metres. Has air trimmer adjustment to get between the FM stations on the dial.



SPY BUG 1000 SB-1000 \$65 (plus \$5.00 pack and post). This bug is capable of transmitting 1km in a built up area (Several kilometres in open country) it is suitable unit for long distance transmission. This unit is the size of a pack of 20 cigarettes and uses 4 AAA cells for power. Battery replacement: \$14.00 (incl return post) after 100 hours use.



SPY BUG 2000 SB-2000 \$120 (plus \$5.00 pack and post). This is our most powerful bug. It is capable of transmitting 2km in a built up area (more in open country) and is suitable for long distance transmission. This unit is the size of a pack of 20 cigarettes and uses 8 AAA cells for power. Battery replacement: \$17.00 (incl return post) after 100 hours use.



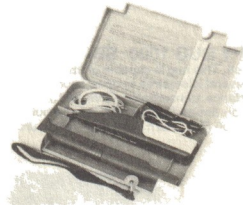
TAPE RECORDER TR-01 \$65 (plus \$6.00 pack and post). This is a specially modified tape recorder with zero standby current for long battery life. Designed for use with Phone Tapes, the unit features AC or DC operation and uses normal tapes. Size 5cm high x 14cm wide x 27cm long.



TAPE RECORDER TR-01S \$105 (plus \$6.00 pack and post). This is the same as TR-01 except it has a slow-down feature that can be adjusted to slow the tape to give up to 2 hours 15 minutes recording time on each side. You must play the tape at the same speed otherwise the voices will be too fast or too slow.

TAPE RECORDER TR-02S \$125 (plus \$6.00 pack and post). This is a palm-sized Sanyo tape recorder that takes standard tapes. It has a control so that you can slow down the tape to 3 hours 15 min per side for a 120 tape.

TELEPHONE LINE TRACER \$140. (plus \$5.00 pack and post). This is the same device as used by telephone linesmen to detect a particular telephone pair in a bundle of wires. The oscillator is clipped to your pair and the receiving wand is taken to any junction box and moved over the wires. A tone will be heard when the wand is passed over the correct pair. Can be used for tracing lines up to 3km. Hire charge: \$20 for up to 3 days. (\$120 deposit)



VOX MK II VOX-02 \$55 (plus \$5.00 pack and post). This is a non-transmitting device to switch a tape recorder ON and OFF. It also has a microphone output for the MIC input of a tape recorder to improve the pick-up of the tape recorder, like the Active Microphone

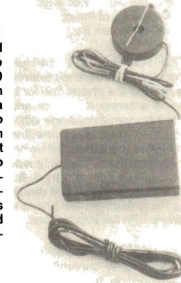


VOX MK IV VOX-04 \$80 (plus \$5.00 pack and post). This is a voice operated bug that only transmits when it picks up sounds. When no sounds are present the bug shuts down to the 'monitoring mode' and sends out a homing beep to let you know you are monitoring the correct frequency. The battery life is increased 300% as it only transmits when sounds are present. It has a very sensitive microphone and an adjustable level control to set the noise level at which the bug turns on.



WALL BUG WB-01

\$50 (plus \$5.00 pack and post). This unit has the same range as the SPY BUG 400 and is fitted with a vibration detector instead of a microphone. It is designed to be attached to a window with Blu Tack and will listen right through the glass. Also called a SPIKE MIC or CON-CRETE BUG it will also listen through walls and doors but the quality is not as good as the Spy Bug-400, for example.



WIRELESS PANIC \$150.00 (plus \$5.00 pack and post).

This alarm consists of a small panic button fitted to a neck-chain. As soon as the wearer presses the button, a loud alarm is sounded and is latched into operation until the reset button is pressed. Ideal for monitoring the elderly. Range: about 25 metres.

This completes our range. All units are fully assembled and tested. All devices comply with Austel requirement 5.9.3.4(c) covering the tapping of telephone conversations and thus it is not possible to intercept a communication over the telecommunication system. However none of the devices have been approved for attachment to a public telephone system and must therefore not be attached.

All products are sold on the understanding that they be used for your own personal safety and surveillance. On no account do we sell these devices for the purposes of breaking any laws etc. All devices are guaranteed and we can modify certain units for specific requirements.

Contact: Talking Electronics,

**35 Rosewarne Ave,
Cheltenham, Vic 3192**

Tel: (03) 584 2386

OPERATING INSTRUCTIONS

100 metre, 400 metre, 800 metre, 1km & 2km FM TRANSMITTERS and 400 METRE WALL BUG

The 6 FM transmitters are identified as follows:

100 metre: heatshrunk. About the size of 4 x 20¢ pieces.

400 metre: small black box about the size of a match-box with flip-top lid with two AAA alkaline cells inside.

800 metre: fits on top of 9v battery. Has screwdriver adjustment for freq.

1km: black box with on/off switch and 4 AAA alkaline cells inside.

2km: black box with on/off switch and 8 AAA alkaline cells.

400 metre wall bug: has a piezo diaphragm connected via twin lead.

These are very popular FM transmitters and are guaranteed to transmit the distance stated, provided the antenna is fully extended and the receiving radio is a good quality (turn-the-dial) type with a telescopic antenna extended as shown in the diagram. Walkman-type radios and pocket radios will get about half the range.

All the above transmitters operate on the FM band (88MHz to 108MHz) and each unit has been pre-set to a fixed frequency at the lower end of the band. The exact frequency is set during manufacture and is shown on the outside of the unit or on the plastic bag housing it. The frequency for the 800m transmitter can be adjusted slightly from the manufactured frequency by turning the trimmer (its looks like a screw protruding through the heatshrink) with a non-metallic screwdriver.

It has only about 2MHz effect on the frequency and this will allow the transmitter to be tuned away from any local radio stations. If you require a frequency that is higher or lower than that obtainable by adjusting the trimmer, ring Talking Electronics.

The most suitable frequency for any transmitter will depend on a number of factors.

The most important factor is to keep the transmission away from all other radio stations etc. This will give you the best range and the least interference.

The best radio for picking up a bug is a manually tuned type. It can be a car radio, or portable radio and must have a turn-the-dial type tuning. This type of radio has a feature called AFT or AFC and this will allow the radio to "pull onto" the bug.

Digital radios, such as car radios and some walkman-type radios are not suitable as they jump in steps of 100kHz (or 50kHz etc) and since the bandwidth of a bug is only a few kHz, the radios will jump over the transmission or sit beside the actual frequency and you will get only a very short range. The same applies to scanners. These jump in steps of 5kHz, 12.5kHz, 25kHz or 50kHz and you must select the smallest step when picking up the bugs.

After many hours of use, the voltage of the batteries in the transmitters will drop a small amount and the frequency of transmission will change slightly. With a manually tuned radio you can re-tune it to the bug and the signal will be picked up again. With a scanner, you must put it into "LOOP mode" as scanners do not have AFC, so that if the frequency of the transmitter changes, the scanner will begin to search the loop and pick it up again. A 100kHz loop is best, making sure the limits are 50kHz above and 50kHz below the pre-set frequency.

OPERATING INSTRUCTIONS

To switch the 400 metre and WALL bugs ON, open the door at the end of the case, move the slide switch to the red mark and close the door. For the 800 metre bug, fit a 9v battery to the clips and the bug is ready to transmit.

For the 1km and 2km bugs, click the toggle switch to the red mark.

Unwind the antenna to its full length and place the unit on the top shelf of a cupboard or bookcase and lay the antenna along the shelf OR down the side. For the 400 metre WALL BUG, stick the piezo vibration-detector microphone on to a solid medium such as glass, metal or ceramic tile with the two pieces of 'Blu Tac' provided.

Tune your FM radio to the frequency marked on the case and you will be able to pick up all the sounds in the room. The WALL BUG will hear through a sheet of glass with amazing clarity but it is not as clear as being in the room itself, so don't

expect the impossible with this type of pick-up.

All units can be left ON continually and the batteries will last about 200 hours for the 400 metre devices, 50 hours for the 800 metre device and 100 hours for the 1km and 2km devices. When not required, they should be switched OFF. After the operating time has run out, the 100 metre, 400 metre, 1km and 2km devices can be sent to us with a money order as explained on the cover of this catalogue, and we will change the batteries. If you fit a 9v alkaline battery to the 800m model it will transmit for about 100 hours. When the antenna is outstretched fully, the range of each of the bugs is as stated above. If you require a shorter range, the antenna can be cut shorter or wound up so that the bulk of the wire is at the end of the antenna (away from the box). For example, a 20cm antenna will transmit about 20 metres and a 50cm antenna will transmit about 100 metres for the 400 metre model.

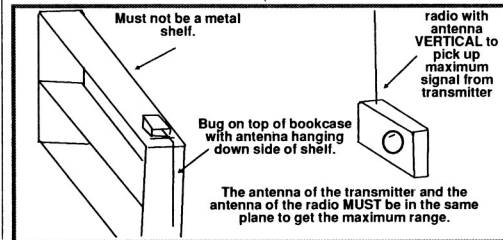
DETECTION

All the bugs can be detected by a bug detector called "BUG DETECTOR 2000." These units are available from Talking Electronics for \$150.00 plus \$5.00 post and they will detect all types of transmitting devices. To minimise the chance of detection, the antenna on the transmitter should be kept as short as possible.

GUARANTEE

All transmitters are guaranteed for 12 months. They will not wear out or lose efficiency if handled with care and not tampered with in any way. The only item(s) needing replacement are the batteries. These are soldered in place for the 400 metre, 1km and 2km devices to prevent faulty contacts.

To replace the AAA alkaline cells you should send the unit to us. Always keep your transmitters in a safe place. Their use in the wrong hands must be avoided. All transmitters are the most sophisticated on the market and additional units are available if you need them. See the list at the end of this catalogue.



THE INFINITY BUG

The INFINITY BUG is one of the world's most amazing devices.

It can be placed at a distant location (such as in an office or factory) and can be activated from any phone in the world. The sounds in the room will be picked up by the inbuilt microphone and sent down the phone line.

Talking Electronics has perfected the Infinity Bug to a point where it does not allow the phone to ring in the room being monitored and thus intruders etc will not be alerted.

Here is a description of how it works and how to access it:

The infinity bug comes in three forms: SIMPLE, RING and NO RING.

Infinity Bug Sizes:

Simple: 60mm x 20mm x 8mm

Ring: 55mm x 37mm x 10mm

No Ring: 80mm x 37mm x 10mm

These notes cover the three types and you will be able to work out the sections that refer to the simple Infinity Bug and those that refer to the other two.

The simple Infinity Bug comes with two alligator clips that are clipped onto the two phone wires (called parallel connection). The Ring version and No Ring version come with a tee piece that plugs into the socket on the wall. The wiring in the plug is both series and parallel but this is not important as there is no wiring required by the installer.

Both the Ring and No-Ring Infinity bug are connected to the phone line by inserting the Tee piece into the socket on the wall and plugging the phone into the end of the tee piece.

The Infinity Bug is now ready to monitor the room in which it is located.

It can be installed in your home, at the office or factory and is ideal for checking on the presence of staff, burglars, the running of machinery or keeping tabs on the children.

The inbuilt microphone is very sensitive and will pick up the ticking of a clock, baby movements, voices, noises etc. It does not use the microphone in the handset of the phone and in fact, the phone can be removed from the line as it plays no part in the operation of the Infinity Bug.

To operate the Bug, the number on which it is connected is dialled (this can be done from anywhere in the world) and

you must only let the phone ring for ONE RING.

At the receiving end (the Infinity Bug end) this ring will be suppressed by the circuit in the No-Ring version and the bell will not sound (if the phone is connected to the line).

If you let the phone keep ringing, the bell will start to sound after about 3 rings and the call will come through just like any normal call.

After one ring you must hang up, count exactly 28 seconds and dial again. The phone will ring once (in the earpiece) and stop.

This means the Infinity Bug has picked up the phone. You must now wait 5 seconds for the suppression circuit to cancel out (you may hear a slight click when this happens). You must then whistle loudly down the line. If you are not capable of doing this, a Scout whistle can be purchased from any Scout shop.

The Infinity Bug will open up the line

By law, this device is to be connected only to your own personal telephone line and not the public phone system. It is not to be used for any illegal activity, (If any illegal activity is able to be performed with it).

and you will be able to hear all the sounds in the room as if you were there.

If someone goes to use the phone, you must hang up and the bug will automatically hang up too (otherwise the caller will come through to you).

A 2 minute timing circuit in the Infinity Bug hangs up the bug after 2 minutes and to open it up again you must whistle down the line.

This can be repeated every 2 minutes to keep the line open indefinitely.

When you hang up, the Infinity Bug hangs up after the 2 minute period.

All three infinity bugs work in another mode too.

After making a normal phone call, the person being called will hang up at the end of the conversation. But you must hang up. Instead, you must whistle down the line and the bug will open up so that you will be able to hear what goes on after the call has terminated.

Note: Only YOU can activate any of the Infinity Bugs as no-one else knows the

secret of whistling down the line. Likewise, only you can activate the Ring and No-Ring versions as the timing sequence has to be just right.

The Infinity bug is only "active" for the period 28 seconds to 60 seconds after the first single-ring is made. If the phone number is very long (such as long distance, STD etc) you must arrange the timing so that the phone will begin to ring during this 32 second interval. If you make a mistake during the second dialling, you must wait 2 minutes for the circuits to reset. You must then start over again.

SUMMARY

For Simple Infinity Bug:

This Infinity Bug is connected to the line in parallel. That is between pint 2 and 6 of the telephone wall socket or between terminals A and B inside the base of the phone.

After making a normal, the person being called will hang up at the end of the call. But you don't. Instead you whistle down the line and the bug will open up so that you will be able to hear what goes on after the call has terminated.

A 2 minute timing circuit in the Infinity Bug hangs up the phone after 2 minutes. To open up the line you must whistle down the line again. This must be repeated every 2 minutes to keep the bug open.

When you hang up, the bug hangs up after 2 minutes.

For Ring and No-Ring version:

Fit Infinity Bug onto line to be monitored.

Ring the monitored line for ONE ring and hang up.

Count 28 seconds and dial again. The phone will ring once and stop.

Wait 5 seconds for the bug to settle.

Whistle down the line and the bug will open up.

You will need to whistle down the line every 2 minutes to keep the Bug open.

If you have a tone dial phone, you should wait 35 seconds before redialling as tone dialling is very quick.

NOTE: Because the wiring of the tee piece involves parallel and serial connection to the phone line, it would be difficult for the installer to fit the RING or NO RING versions without the tee piece.

The Infinity bug is designed and manufactured by:

TALKING ELECTRONICS

Tel: (03) 584 2386

BUG DETECTOR 2000

INSTRUCTIONS FOR USE

The BUG DETECTOR 2000 uses the 'Broad Band' principle for locating transmitting devices hidden in a room, office or car.

It will detect bugs with an output power as low as 1mW and pick up RF in the range 20MHz to 200MHz. This covers all the low-cost bugs (in the range \$30 to \$300).

With the Broad-Band principle, you do not have to scan through the bands and this makes it a very fast method of detecting RF energy. It will detect both FM and AM transmission., however you will rarely find an AM transmitter as it is very noisy and requires a lot of power to get the same range as an FM bug.

When "Bug Detector 2000" is switched ON and the antenna extended, you may hear a jumble of radio stations, taxis and CB's, (depending how much traffic is in your area). This proves the unit is operating as it is picking up all the RF energy within the band mentioned above. Don't worry about any of this background transmission as it will not affect the operation of the Detector or its ability to pick up a bug.

To locate a bug, switch the unit ON and extend the antenna. Walk around the room with the detector held in one hand. Hold your arm outstretched so that the telescopic antenna reaches over and around all the objects in the room. The volume should be turned up full and you can make as much noise as you like to turn on any 'voice activated' bugs. Noise will also assist in creating a feedback signal and you will hear this from the speaker as a squeal, when a bug is located.

Depending on the power of the bug, the length of its antenna and the sensitivity of the microphone, you may have to be right on top of it to get a feedback signal (this is a low sensitivity bug). A sensitive bug will produce a squeal at 3-4 metres.

When a feedback whistle is detected, turn the volume down to zero and the meter will come into operation. As you get closer to it, the pointer will deflect up-scale. For low power bugs you may have to be right on top whereas a high power bug will deflect the needle at 5 metres.

Once you have accepted the fact that a bug exists, you have to 'home-in' on it and find its actual location.

It may be hidden behind a book, under a shelf, in a pile of rubbish or behind a ventilator.

This is where the meter comes in. It effectively tells you when you are getting closer or further from the bug.

With the volume turned down, the detector will be able to pick up the RF energy from the bug and deflect the meter.

Move the BUG DETECTOR around the room until the meter is deflecting full scale. Now reduce the length of the antenna by pushing it slightly into the case.

This will allow you to get closer. Push the antenna further into the case and the meter will only deflect when the antenna is right on top of the bug.

This is how to get right on top of the bug. You need to let the Bug Detector do all the work as a transmitting device can be placed almost anywhere (like behind a picture, under a table, on top of a book-case, under a pile of papers etc) and you must 'home-right-in' before starting to take things apart.

One point of caution. If you are very smart, you will keep your findings to yourself. Once you have found a bug, carefully monitor its location to see who comes to take it away (or replace the batteries etc). Alternatively you can feed it false information and this may flush out who is monitoring your discussions.

The Detector 2000 will also pick up 'beeper bugs' and 'car trackers.' Keep in mind that the antenna of a transmitter must be away from metal objects and exposed to the surroundings for the signal to be radiated. It must be on the outside of a car, under it, or near a window to be effective.

AM and FM signals will travel through glass, brick, wood, plaster and concrete without any reduction in strength but they will not travel through metal of any kind such as corrugated iron, tin-plate (car body-work), aluminium cladding, or wire mesh such as found in reinforced concrete.

The Detector 2000 can be used in the MONITOR mode by leaving it ON and watching the needle whenever someone comes into the room. Turn the volume to zero for this mode.

The Bug Detector 2000 uses a 9v battery (type 216) and will operate for about 10-20 hours. Switch the unit off when not in use to conserve the battery.

To replace the battery, remove the 4 screws on the lid of the Detector.

MORE HINTS

Generally, you can feel fairly safe if you sweep the 20 - 200MHz band but you must remember that bugs can be brought in to the area at any time after a sweep and nullify the exercise completely.

Voice Activated (VOX) bugs require sound or noise to turn them on and it is necessary to make as much noise as possible when sweeping, to open up these devices.

Phone bugs require a little more effort as they can be placed anywhere on the phone line. They are designed to transmit when the handset is lifted and can be placed anywhere in the phone itself, along the line, in a junction box or even external, such as in a phone pit or on a power pole.

BUG DETECTOR 2000 is capable of detecting these bugs via a very clever method.

Simply coil the phone cord about 4 times around the telescopic antenna and place the mouthpiece of the handset to the speaker on the DETECTOR.

If a transmitting bug is present on the line, you will hear a feedback whistle.

Don't worry about any other noises such as motor-boating, radio stations, taxis or CB's as the phone line is increasing the sensitivity of the bug detector and it is acting like a radio, picking up all the transmissions in the area.

You will only get a feedback whistle if the bug is within about 30 metres of the phone and you will not be able to detect a bug at the exchange or on a pole at the end of the street as the RF signal is too small for the detector.

To pick up a bug on a pole in the street or in a pit, you will have to keep the phone off the hook and take the detector into the street and scan each of the poles. It is best to dial a recorded service or place a radio near the phone so that you can pick up the audio when it is transmitted by the bug on the pole.

Room intercoms such as those connected to the mains provide a relatively poor means of listening to room conversation and since they must be connected to the power, you should investigate all power outlets, including powerboards and extension leads.

One final point.

You can never "guarantee" a room is free of listening devices after a sweep as the device may operate on a very low frequency, or very high frequency or be brought into the room in a briefcase during a meeting. The device may be a tape recorder in a briefcase and unless you request to search all personnel, you will never be able to find it.

CAR TRACKER

CT - 03

Standard Model: \$85.00
Magnetic Model: \$95.00

CT-03 is the latest model in our CAR TRACKER series. It indicates when a car turns left, right or stops.

When the tracker is at rest, it produces a brief beep at approx half-second intervals. When placed correctly on a car (as explained below), the beep rate and tone change when the car turns left or right or stops. This change is picked up on an FM receiver and it is easy to work out what is happening.

When the car turns left, the beep rate increases.
When the car turns right, the pitch increases.
When the car brakes hard, both beep and pitch increase.

The CT-03 can be placed on the back parcel shelf of a car or under the rear bumper bar. Depending on where it is placed, its transmission range will be 200 - 400 metres. The best place is on the rear parcel shelf as shown in the diagram. The two antennas must be outstretched fully so that the signal can pass through the back window.

When placed under the car, the antennas must be fully extended and tied to the chassis with the wire drooping so that it is not near the framework of the car. In this position the range will be about 200 metres.

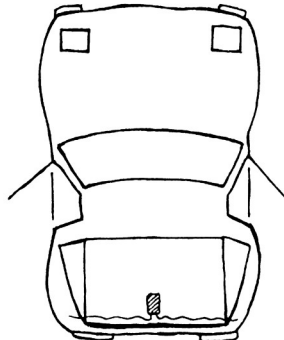
The Car Tracker contains a very complex FM transmitter and two carefully positioned mercury switches. For them to work correctly, the Tracker must be placed on a flat horizontal surface with the front of the Tracker facing the front of the car.

The tracker is designed to fit under the car, near the rear bumper and has a

piece of double-sided foam tape for attaching to a clean surface.

If you intend to place it on a rear parcel shelf, this foam tape must be on top and you can use 'blue tac' on the other side to keep it in place.

No matter where you place it, the antennas must be kept away from the



The CT-03 placed on the back parcel shelf of a car

framework as the metal will reduce the signal considerably. The signal can only pass through glass and to get the best output you will need to do some adjusting of the position of the Tracker to get it to respond to left and right turns and quick stops. The foam tape will allow a small degree of movement and you can use a match to tilt the Tracker slightly.

DETUNED FM TRANSMITTERS AND RADIOS

In some areas the FM band, between 88-108MHz, is completely filled with commercial radio stations and community radio stations. The only way to get a clear spot is to go below the band, into the 86-88MHz band, by using a detuned FM radio.

This will allow you to operate on a clear frequency and be away from the commercial broadcast stations.

Detuned cassette radios are available from us for \$85.00 and these will allow you to pick up the lower frequencies and record the information.

Detuned transmitters can also be obtained from us for transmission on the 87MHz band. The cost of these transmitters is \$10 more than the prices listed on page 74.

Please ring before calling so that the units will be ready for pick-up.

The Tracker can only be detected on a manually tuned FM car radio or good-quality portable radio. The frequency of transmission is shown on the Tracker and is generally between 88MHz - 91MHz but can be made to any desired frequency. You cannot use a digital car radio to pick it up as this type of radio increments in steps of 25kHz or 100kHz and will jump over the Tracker. You will only be able to pick it up when you are very close and this is of little use.

By law, you are only allowed to attach a tracker to your own car or one that has the authority of the owner. It can be used to protect your own car from theft or in a car-hunt rally etc.

It can also be used to detect the theft and movement of products in boxes etc. When the item is moved, the tone of the transmitter will change and immediately alert you.

Battery life for the Car Tracker is more than 300 hours as the unit is only drawing current when it is beeping. The duration of this beep is less than 10% of the on-time.

If the Tracker is used in an open situation such as for a farm gate, the range is approximately 1km, but near a car or under any type of metal-work, the range is severely reduced as the signal is obstructed by metal.

Two models are available:

The standard model has double-sided tape so that the tracker can be stuck to a clean surface.

Price: \$85.00

The magnetic model has a strong magnet fitted to the bottom of the unit so that the tracker can be attached to any metal object.

Price: \$95.00

NEW! SLOWED-DOWN TAPE RECORDER

A palm-size tape recorder Sanyo type M-1119 measuring 90mm x 130mm x 35mm has just been made available from Talking Electronics Security Systems. A slow-down feature has been added so that each side of a 120 tape will record for up to 3 hours 15mins. This slow-down is fully adjustable with an easy-to-turn adjustment.

The advantage of this tape recorder is it takes standard tapes and can be used with our phone-tape products or for recording conversations in a room. It also has voice activation.

Cost: \$125.00

C-120 tapes \$5.00 each

PHONE BUG SNIFFER PBS - 01

The Phone Bug Sniffer is an invaluable aid for finding out if your private conversation is being monitored by unauthorised persons.

It alerts you to 4 different types of illegal monitoring and one counter-measure.

The Phone Bug Sniffer must be set up for the particular line you wish to monitor and thus the set-up of the device during manufacture is only approximate.

It must be set accurately when you install it.

To do this, unplug the phone from the wall and plug the tee piece adaptor on the Phone Bug Sniffer into the wall socket. Then plug the phone into the tee piece and switch the unit on.

SETTING UP

On the side of the Phone Bug Sniffer you will find two holes labelled BUG ON LINE and EXTENSION PHONE IN USE.

Lift the handset and carefully insert the screwdriver provided into the EXTENSION PHONE IN USE hole so that it fits into the slot of the adjustment pot.

Now turn the pot until the EXTENSION PHONE IN USE LED just turns off. Mark the position of the screwdriver.

Now hang up the phone and adjust the same pot until the LED goes off.

Mentally mark the position again. With the phone still down, set the pot to the mid position of these two marks. Pick up the phone and also the extension phone. The "EXTENSION PHONE IN USE" LED will come on. When the extension phone is picked up, both the "EXTENSION PHONE IN USE" LED and "PHONE IN USE" LED will come on.

Next, pick up the phone and adjust the BUG ON LINE pot until the BUG ON LINE LED just goes off.

This is done assuming there are no bugs on the line at the time. If any bugs are fitted after the Phone Bug Sniffer is fitted, you will be alerted.

Put the phone back on the hook and press the RESET button. The RESET button must be pushed every time the phone is put back on the hook.

All the LEDs on the unit should be off.

This concludes the setting up procedure.

PHONE IN USE

If you pick up the phone, the PHONE IN USE LED will come on. This LED tells you when the main phone has been picked up.

EXTN PHONE IN USE

This LED turns on when another phone, remote to where you have installed the PBS-01, has been picked up so you know if someone else is listening in to the phone.

INFINITY BUG

Read the notes on the INFINITY BUG to see what it is and how it works.

It is a device that is put on your line and activated from another telephone to listen to the room conversation.

The INFINITY BUG LED will come on and stay on if your line is being used by one of these devices. A piezo will also beep every 10 seconds to let you know that your phone has been tampered with while you were absent.

The Phone Bug Sniffer will also turn on the Infinity Bug LED and beep if you pick up the phone and don't dial a number - so always hang up the phone and push reset to prevent a false triggering.

PHONE TAPE INHIBIT

All automatic switching Phone tapes like our PT-01 detect line voltages to switch on a tape recorder. When the handset is on the hook, the line voltage is 45v - 55v and when the handset is lifted, the voltage drops to 6 - 15v.

When the voltage is high, the Phone Tape knows you are not using it, but when it is low, the phone tape turns on a tape recorder.

It is not possible to detect any of these Phone Tapes but it is possible to defeat them.

The INHIBIT feature does this.

It increases the line voltage to 30 - 35v when you are on the phone thus fooling any Phone Tape into turning off the tape recorder. When you release the button the tape turns on again.

The inhibit button is used only very sparingly, when you wish to give a place-name or other vital statistic. This way anyone taping the conversation will get all the background details but miss out on the facts. If you use the INHIBIT too much anyone listening to the tapes will realise they contain only a fraction of the conversation and try another method of intrusion, such as hard-wiring, and this will be impossible to defeat.

INSTRUCTIONS FOR FITTING THE SCORPION SC-01

The Scorpion is a transmitting device for connecting to the phone. It will transmit on 88 - 92MHz (or any specified frequency), when the handset is lifted.

It is connected in series with one line. It can be connected to either line and it does not matter which way around the alligator clips are connected, the circuit inside the Scorpion will adjust automatically.

The Scorpion can be fitted to either a normal phone or Commander installation.

For a normal phone, you can place the Scorpion anywhere along the line or inside the phone. Select either the wire going to terminal 2 or terminal 6 and cut the wire.

Connect the alligator clips so that the Scorpion joins up the circuit and the job is done.

If the Scorpion is to be connected inside the phone, cut one of the incoming phone wires and connect the alligator clips to join up the circuit.

If the phone is electronic, and has a US 4-pin plug on the PC board, you can get a unit specially designed to plug into the PC board (\$10.00 extra). Otherwise you will have to cut one of the leads going to the plug and re-connect the circuit by connecting the alligator clips.

COMMANDER INSTALLATION

For a Commander Installation, there are 4 lines to each slave. 2 lines (2 wires) are for talking and the other two are control lines (control wires). To find the talking wires, (they are normally terminals 2 and 6) you will need a multimeter. Connect the meter to terminals 2 and 6. Measure the voltage when the handset is down. When the handset is lifted, the voltage will go down to 2-6v.

Connect the Scorpion and make sure no bare wires are touching any other part of the circuit. Test the unit before putting the phone back together.

RF OPERATED TAPE RECORDER

For RF operation, flick the switch on the back of the tape recorder, to the "RF ON" position. Slide the band select switch to FM.

Tune across the band and watch the LED behind the tuning pointer. It will illuminate when a station is tuned in.

It will also turn on when a bug is picked up.

If the bug is voice activated (VOX) the bug will turn off when it does not hear any sounds. This will make the LED on the RF tape recorder turn off too.

When record button is pressed and a cassette is in the unit, the tape recorder will record only when the LED is illuminated.

To listen to the tape, turn the RF switch OFF and the recorder can be used in the normal way.

TALKING ELECTRONICS P/L
 35 ROSEWARNE AVENUE ACN 006600997
 CHELTENHAM 3192
 VICTORIA Telephone: (03) 584 2386
 FAX: (03) 583 1854

Name: _____
 Address: _____

 _____ post code: _____
 Telephone: _____

ORDER FORM

cat. No:	Description	cost:	Qty:	\$
ACT-01	Active Microphone for micro-cassette recorders	\$45		
BC-01	Room transmitter a brief case. (Case supplied).	150		
BD-2000	Bug Detector locates transmitting bugs. 20-200 MHz . . .	150		
CT-03	Car tracker version 3. Beep - beep and left/right/stop . . .	\$85 & \$95		
DA-01	Double Adaptor bug. A scorpion in a Double Adaptor. . .	140		
IBR-00	Infinity Bug (simple). Listen after other party hangs up . . .	150		
IBR-01	Infinity Bug, coded auto answer. Ring version.	250		
IBNR-02	Infinity bug, coded auto answer, No ring version.	350		
LI-01	Listener. Phone amplifier for hearing impaired & fax lines . .	75		
MB-01	240v Mains powered bug in a double adaptor	140		
MC-02	Micro-cassette recorder (voice activated)	120		
MM-01	Ministers Microphone. Ideal for Estate agents, Ministers etc	65		
PBS-01	Phone Bug Sniffer. Detects bugs on telephone line . . .	150		
PT-01	Phone Tape with motor on/off control	120		
PT-01T	Phone Tape with motor control & Tee piece	130		
PT-05	Phone Tape, records 1st 5 minutes of each call.	140		
PT-05T	Phone Tape, records 5 minutes of each call & Tee piece .	150		
RFT-01	RF Operated tape recorder.	180		
RFT-01S	RF Operated tape recorder with motor speed control. . .	220		
SC-01	Scorpion phone transmitter	140		
SC-02	SC-01, with 4 pin U.S. plug for electronic phones.	150		
SC-03	Phone Tx, parallel connection, transmits up to 2km . . .	220		
SP-01	SC-01, with antenna for better range in poor areas. . . .	140		
SB-100	Spy Bug 100 metre room transmitter.	85		
SB-400	400 metre room transmitter	50		
SB-800	800 metre room transmitter	55		
SB-1000	1km room transmitter	65		
SB-2000	2km room transmitter	120		
TR-01	'International' AC/DC tape recorder for Phone Tapes . . .	65		
TR-01S	Tape recorder with slow-down to 2hrs 15min per side . .	105		
VOX-02	VOX MkII. Turns any tape recorder into voice operated . .	55		
VOX-04	Transmitting VOX with homing beep	80		
WB-01	Wall bug. 400m transmitter that listens through glass etc. .	50		
	Other devices: see pages 65, 66, & 67:			

Same day pick-up from 35 Rosewarne Ave or next day delivery by post.

sub total:

Credit card number: See full descriptions on pages 65, 66 and 67.

Discount:

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Postage:

Postage:
 \$5.00 per item except brief case or tape recorder.
 Brief case or tape recorder \$10.00
 Air mail \$10 extra. Post free for orders over \$500.

Discounts:
 3 or more of any device - less 10%
 10 or more of any device - less 15%

TOTAL:

Send Money Order, Cheque or credit card details.

$\frac{1}{2}$ Price Scoop!

Hinari Disc Decks

Features:

Digital Programmable Compact Disc Player

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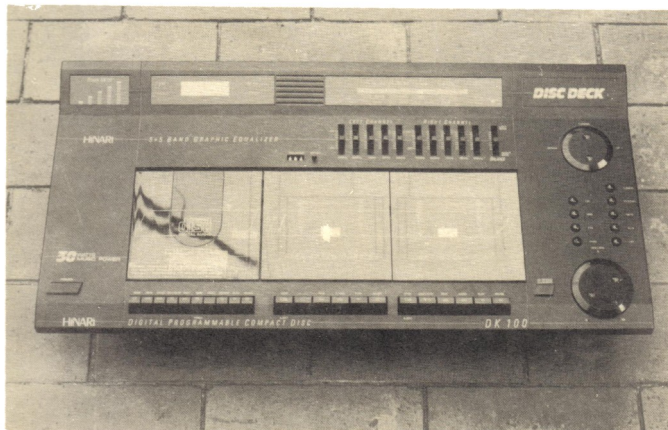
Twin Cassette with High Speed Dubbing

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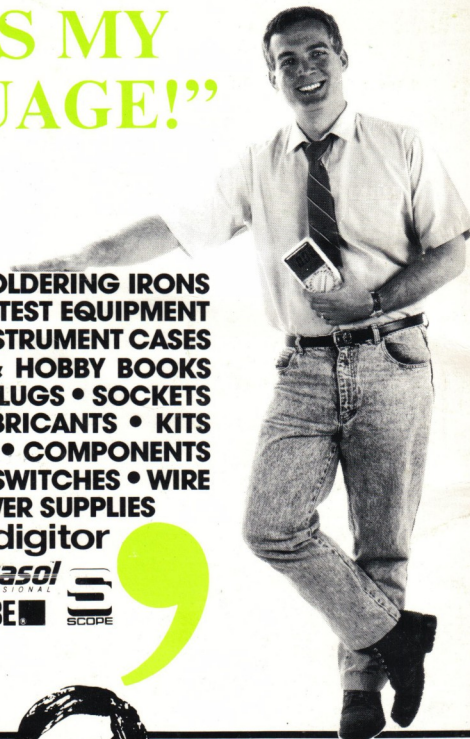
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